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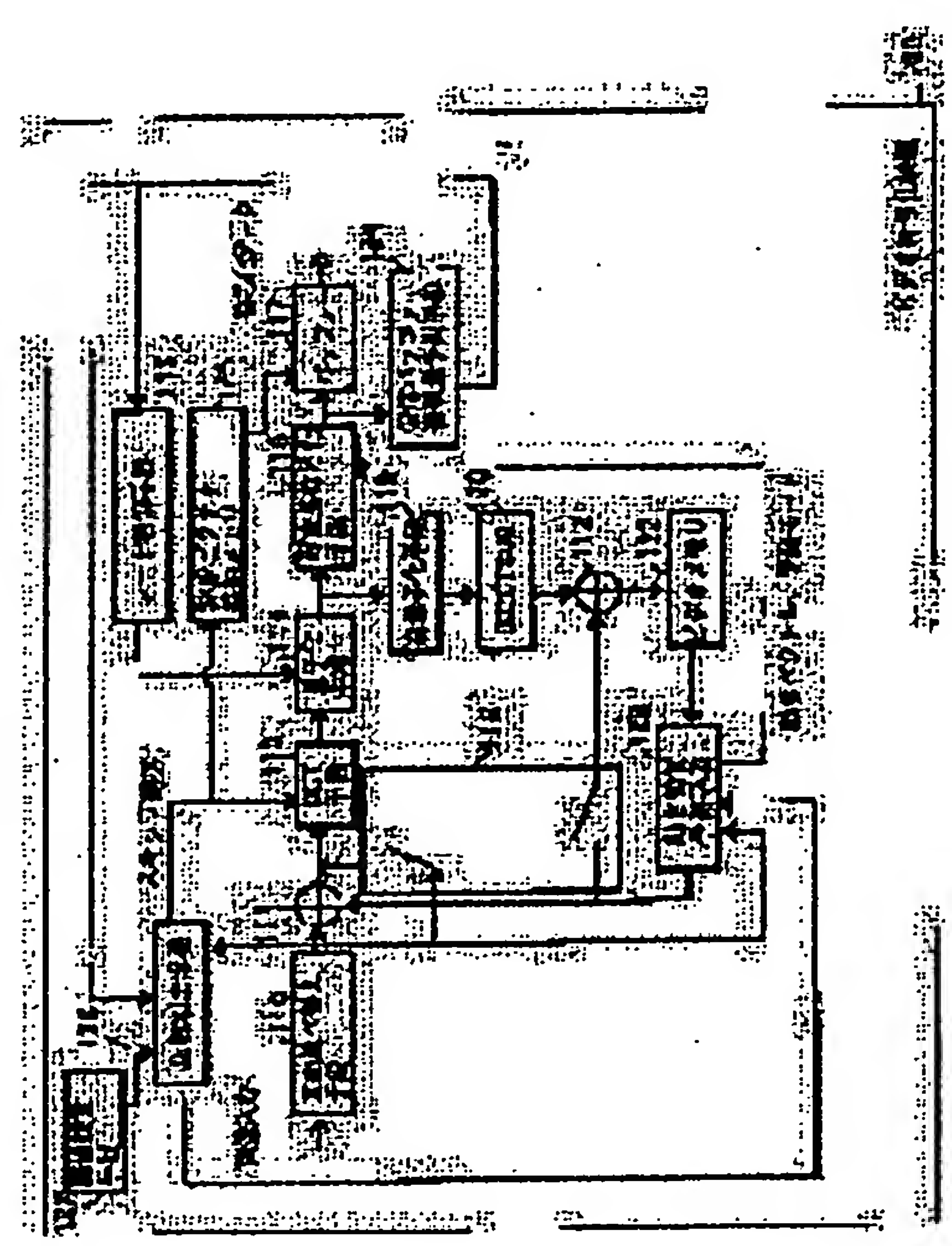
(54) DEVICE FOR CODING VIDEO

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a device for coding video such that a special buffer for determining whether or not the entire picture is to be skipped becomes unnecessary and the sequence of video is not reversed even if the entire picture is skipped.
SOLUTION: A comparative determination means 125 compares a predicted amount of accumulation in the receiving buffer of this decoding device with a threshold set on each of picture types, on every single picture data before the picture data is decoded. The comparative determination means 125 determines that a coding processing of image data is to be skipped, making DCT means to stop the coding processing, when the predicted amount of accumulation in the receiving buffer is under the threshold. Further, the comparative determination means 125 produces the outputs of all skip pictures such that all remaining macro-blocks except the top and bottom of a slice layer in a skip picture storing memory 126 consist of the skipped macro-blocks.



CLAIMS

[Claim(s)]
[Claim 1]A video coding device which codes image data of one frame or the 1 field while predicting an accumulated dose of a receive buffer in a decoding device characterized by comprising the following.
A prediction accumulated dose predicted to probably be accumulated in a receive buffer in decryption time of coding data of the image data concerned before coding image data.
A comparison means to compare a predetermined threshold.
When a prediction accumulated dose is less than a threshold, as data which stops coding of said image data and is taken out from a receive buffer at said decryption time, A skipping means using a proxy code which defined that the image data same instead of coding data of said image data as image data decrypted in the past should have been displayed.

[Claim 2]The video coding device according to claim 1 which is said video coding device and is characterized by including ************** which sets a threshold further to every [of a picture by which image data is coded] type (I picture, P picture, or B picture).
[Claim 3]When a picture type is B picture, said skipping means, All the macro blocks of the remainder except the beginning of a slice layer and the last use an all skip B picture which is a B picture which comprises a skip DOMAKU lob lock as a proxy code, When a picture type is I or P picture, The video coding device according to claim 2, wherein all the macro blocks of the remainder except the beginning of a slice layer and the last use an all skip P picture which is a P picture which comprises a skip DOMAKU lob lock as a proxy code.
[Claim 4]The video coding device according to claim 3, wherein a threshold of said threshold setting means is a prediction code amount.
[Claim 5]The video coding device according to claim 3 which said threshold setting means computes a variance of a pixel value for every image data, and is characterized by setting up a bigger threshold, so that the variance concerned is large.
[Claim 6]Said threshold setting means makes VAR_j the minimum of the variances of a pixel value of image data in each 8 blocks (4 blocks in frame DCT mode, and 4 blocks in field DCT mode) block included in the macro block j, When an activity of the macro block j is made into act_j, it is considered as $act_j=1+VAR_j$ and the activity ACT of image data is considered as total of an activity of all the macro blocks, The video coding device according to claim 3 with which it is characterized by setting up a bigger threshold as a picture with the big activity ACT of image data.
[Claim 7]The video coding device according to claim 3, wherein said threshold setting means sets each prediction code amount as a threshold about I or P picture and sets a bigger value than a prediction code amount of B picture as a threshold about B picture.
[Claim 8]Said threshold setting means in the case of M (I or appearance cycle of P picture)>=2, For a prediction code amount of Ei and P picture, when the amount of transmitted bits per decoding time interval of Eb and one picture is set to R for a prediction code amount of Ep and B picture, a prediction code amount of I picture, If threshold Ti=Ei of I picture, threshold Tp=Ep of P picture, and encoding order make Tb(i) a threshold of B picture in front of I picture, If encoding order sets a threshold of B picture in front of P picture to Tb (p) at the time of Tb(i)=Eb <(Ei-R) 0 the time of Tb(i)=Eb+(Ei-R) (Ei-R)>=0, The video coding device according to claim 7 characterized by considering it as the time of Tb(p) =Eb <(Ep-R) 0 the time of Tb(p) =Eb+(Ep-R) (Ep-R)>=0.
[Claim 9]Said threshold setting means in the case of M (I or appearance cycle of P picture)>=3, For a prediction code amount of Ei and P picture, when the amount of transmitted bits per decoding time

interval of Eb and one picture is set to R for a prediction code amount of Ep and B picture, a prediction code amount of I picture, If threshold Ti=Ei of I picture, threshold Tp=Ep of P picture, and encoding order make Tb2(i) a threshold of B picture (B-2(i)) in front of I picture, the time of Tb2(i)=Eb+(Ei-R) (Ei-R)>=0 -- the time of Tb2(i)=Eb <(Ei-R) 0 -- encoding order -- B-2(i), if a threshold of the last B picture (B1(i)) is made into Tb1(i), At the time of Tb1(i)=Eb+(Tb2(i)-R) (Tb2(i)-R) >=0. If encoding order sets a threshold of B picture (B-2 (p)) in front of P picture to Tb2 (p) at the time of Tb1(i)=Eb <(Tb2(i)-R) 0, If encoding order sets a threshold of B picture (B1 (p)) in front of B-2 (p) to Tb1 (p) at the time of Tb2(p) =Eb <(Ep-R) 0 the time of Tb2(p) =Eb+(Ep-R) (Ep-R)>=0, The video coding device according to claim 7 characterized by considering it as the time of Tb1(p) =Eb <(Tb2(p)-R) 0 at the time of Tb1(p) =Eb+(Tb2 (p)-R) (Tb2(p)-R) >=0.

[Claim 10]Said threshold setting means at the time of M (I or appearance cycle of P picture)>=3. The video coding device according to claim 7 with which encoding order is characterized by encoding order being higher than a threshold of B picture (B1) in front of the B picture (B-2) concerned, and setting up a threshold of B picture (B-2) in front of I picture.

[Claim 11]Said threshold setting means in the case of M (I or appearance cycle of P picture)>=3, For a prediction code amount of Ei and P picture, when the amount R of transmitted bits per decoding time interval of Eb and one picture and a code amount of an all skip B picture are set to Dbskip for a prediction code amount of Ep and B picture, a prediction code amount of I picture, If threshold Ti=Ei of I picture, threshold Tp=Ep of P picture, and encoding order make Tb2(i) a threshold of B picture (B-2(i)) in front of I picture, the time of Tb2(i)=Eb+(Ei-R) (Ei-R)>=0 -- the time of Tb2(i)=Eb <(Ei-R) 0 -- encoding order -- B-2(i) -- if a threshold of the last B picture (B1(i)) is made into Tb1(i) -- Tb1(i) =Dbskip+ (Tb2(i)-R)

If encoding order sets a threshold of B picture (B-2 (p)) in front of P picture to Tb2 (p) at the time of Tb1(i) =EbDbskip+(Tb2(i)-R) <Eb at the time of Dbskip+(Tb2(i)-R) >=Eb, It is Tb2 (p) the time of Tb2(p) =Eb+(Ep-R) (Ep-R)>=0. When encoding order sets a threshold of B picture (B1 (p)) in front of B-2 (p) to Tb1 (p) at the time of =Eb <(Ep-R) 0, it is Tb1(p) =Dbskip+ (Tb2(p)-R).

The video coding device according to claim 10 characterized by considering it as the time of Tb1(p) =EbDbskip+(Tb2(p)-R) <Eb at the time of Dbskip+(Tb2(p)-R) >=Eb.

[Claim 12]In [are a video coding device which codes image data of one frame or the 1 field while predicting an accumulated dose of a receive buffer in a decoding device, and] after coding of image data, According to a picture type, threshold Ti when image data is coded by I picture in the case of M (I or appearance cycle of P picture)>=2, Threshold Ti when a code amount of the I picture concerned was set to Di, it is set as Ti=Di and image data is coded by P picture, If a code amount of the P picture concerned is set to Dp, will set it as Tp=Dp and encoding order threshold Tb(i) when image data is coded by B picture in front of I picture, If a code amount of the B picture is set to Db, a prediction code amount of I picture is set to Ei and the amount of transmitted bits per decoding time interval of one picture is set to R, The time of Tb(i)=Db+(Ei-R) (Ei-R)>=0 At the time of Tb(i)=Db <(Ei-R) 0. If it is alike, set up, threshold Tb (p) when image data is coded for encoding order by B picture in front of P picture sets a code amount of the B picture to Db, a prediction code amount of P picture is set to Ep and the amount of transmitted bits per decoding time interval of one picture is set to R, The time of Tb(p) =Db+(Ep-R) (Ep-R)>=0 At the time of Tb(p) =Db(Ep-R) <0. When it is probably accumulated in a receive buffer in decryption time of coding data of the image data, in after a threshold setting means boiled and set up and numerals of image data A prediction accumulated dose, A comparison means to compare said set-up threshold, and when a prediction accumulated dose is less than a threshold, A video coding device provided with a skipping means using a proxy code which defined that the image data same instead of coding data of said image data taken out from a receive buffer at said decryption time as image data decrypted in the past should have been displayed.

[Claim 13]A video coding device which codes image data of one frame by the frame structure, comprising:

A comparison means to compare an accumulated dose of an output buffer, or a prediction accumulated dose of a receive buffer of a decoding device with a predetermined reference value when coding image data.

When judged with said accumulated dose or a prediction accumulated dose having reached a predetermined reference value, Stop coding by the frame structure of said image data, and instead of coding data of a top field of said image data, and a bottom field, A skipping means using a proxy code which defined that the two same fields as a top field or a bottom field which constitutes image data decrypted in the past should have been displayed.

[Claim 14]a top field where said skipping means constitutes image data decrypted in the past -- moreover -- and among bottom fields, The video coding device according to claim 13 using a proxy code which defined that a display order should display the two same fields as the nearest field on each field of image data which stopped coding by said frame structure.

[Claim 15]When a type of a picture with which said image data which stopped coding by the frame structure was due to be coded is B picture, said skipping means, The beginning of a slice layer, and the last. A type of a picture with which said image data by which all the macro blocks of the removed remainder used as said proxy code two of all skip B pictures which are B pictures which comprise a skip DOMAKU lob lock, and stopped coding by the frame structure was due to be coded I. Or the video coding device according to claim 14, wherein all the macro blocks of the remainder except the beginning of a slice layer and the last use as said proxy code two of all skip P pictures which are P pictures which comprise a skip DOMAKU lob lock in the case of P picture.

[Claim 16]By said all skip P picture used when a type of a picture with which said image data which stopped coding by the frame structure was due to be coded is I or P picture, said skipping means. A display order makes a reference field a bottom field of image data of I used as the point, or P picture, In said all skip B picture which is used in the case of B picture (B1) by which a type of a picture with which said image data which stopped coding by the frame structure was due to be coded is coded just behind I or P picture. A display order makes a reference field a bottom field of image data of I used as the point, or P picture, In said all skip B picture which is used in the case of B picture (B-2) by which a type of a picture with which said image data which stopped coding by the frame structure was due to be coded is coded just before I or P picture. The video coding device according to claim 15, wherein a display order makes a reference field a top field of image data of I which becomes the back, or P picture.

[Claim 17]When a type of a picture with which said image data which stopped coding by the frame structure was due to be coded is I or P picture, said skipping means, Stop coding of image data coded by B picture after that, and instead of coding data of a top field of the image data concerned, and a bottom field, The video coding device according to claim 17 using two of all skip B pictures to which a display order made a previous bottom field a reference field.

[Claim 18]A video coding device which codes image data of one frame or the 1 field while predicting an accumulated dose of a receive buffer in a decoding device characterized by comprising the following.
A prediction accumulated dose predicted to probably be accumulated in a receive buffer in decryption time of coding data of the image data concerned before coding image data.
A comparison means to compare a threshold for every picture type by which image data is coded.
When a type of a picture with which it is a case where a prediction accumulated dose is less than a threshold, and said image data is coded is B picture, A control means using a proxy code which defined that the image data same instead of coding data of said image data which stops coding of said image data and is taken out from a receive buffer at said decryption time as image data decrypted in the past should have been displayed.

[Claim 19]A video coding device which codes image data of one frame or the 1 field while predicting an accumulated dose of a receive buffer in a decoding device characterized by comprising the following.
A prediction accumulated dose predicted to probably be accumulated in a receive buffer in decryption time of coding data of the image data concerned before coding image data.
A comparison means to compare a threshold for every picture type by which image data is coded.
When a type of a picture with which it is a case where a prediction accumulated dose is less than a threshold, and said image data is coded is B or P picture, A control means using a proxy code which defined that the image data same instead of coding data of said image data which stops coding of said image data and is taken out from a receive buffer at said decryption time as image data decrypted in the past should have been displayed.

[Claim 20]A video coding method which codes image data of one frame or the 1 field while predicting an accumulated dose of a receive buffer in a decoding device characterized by comprising the following.
A prediction accumulated dose predicted to probably be accumulated in a receive buffer in decryption time of coding data of the image data concerned before coding image data.
A step which compares a predetermined threshold.
When a prediction accumulated dose is less than a threshold, as data which stops coding of said image data and is taken out from a receive buffer at said decryption time, A step using a proxy code which defined that the image data same instead of coding data of said image data as image data decrypted in

the past should have been displayed.

[Claim 21]A video coding method which codes image data of one frame by the frame structure, comprising:
A step which compares an accumulated dose of an output buffer, or a prediction accumulated dose of a receive buffer of a decoding device with a predetermined reference value when coding image data.
When judged with said accumulated dose or a prediction accumulated dose having reached a predetermined reference value, Stop coding by the frame structure of said image data, and instead of coding data of a top field of said image data, and a bottom field, A step using a proxy code which defined that the two same fields as a top field or a bottom field which constitutes image data decrypted in the past should have been displayed.

[Claim 22]Predicting an accumulated dose of a receive buffer in a decoding device in order to code image data of one frame or the 1 field a computer, A prediction accumulated dose predicted to probably be accumulated in a receive buffer in decryption time of coding data of the image data concerned before coding image data, A comparison means to compare a predetermined threshold, and when a prediction accumulated dose is less than a threshold, As data which stops coding of said image data and is taken out from a receive buffer at said decryption time, A video coding program for making it function as a skipping means using a proxy code which defined that the image data same instead of coding data of said image data as image data decrypted in the past should have been displayed.
[Claim 23]A comparison means to compare an accumulated dose of an output buffer, or a prediction accumulated dose of a receive buffer of a decoding device with a predetermined reference value when coding image data for a computer, in order to code image data of one frame by the frame structure, When judged with said accumulated dose or a prediction accumulated dose having reached a predetermined reference value, Stop coding by the frame structure of said image data, and instead of coding data of a top field of said image data, and a bottom field, a skipping means using a proxy code which defined that the two same fields as a top field or a bottom field which constitutes image data decrypted in the past should have been displayed -- a video coding program for making it function by carrying out.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]Especially this invention relates to the video coding device which skips coding of image data and adjusts a code amount about a video coding device.
[0002]
[Description of the Prior Art]The code amount is controlled by video coding based on an MPEG standard, predicting the accumulated dose of the picture of the receive buffer of a decoding device. This is called code quantity control by a VBV (Video Buffering Verifier) model.
[0003]Drawing 20 (a) shows the transition at the time of usual [of the prediction accumulated dose of a receive buffer]. As shown in the figure, a picture is inputted into a receive buffer at a fixed rate. And since one picture is decryption, it is outputted to the time shown by DTS (Decoding Time Stamp) from a receive buffer. When a decoding device has an indicator of NTSC system, DTS assigns one frame to one picture and the 1 field is assigned to one picture every [1/] 30 seconds, it is set up every [1/] 60 seconds. When a decoding device has an indicator of a PAL system, DTS assigns one frame to one picture and the 1 field is assigned to one picture every [1/] 25 seconds, it is set up every [1/] 50 seconds.
[0004]Usually, as shown in drawing 20 (a) at the time, supposing the bit yield of the picture decrypted by DTS1 is D1, in DTS1, the prediction accumulated dose of a receive buffer will decrease to V1 to V1* (=V1-D1). A code amount is controlled by a VbV model so that the prediction accumulated dose of a receive buffer causes neither overflow nor underflow.
[0005]At the times, such as a scene change, like drawing 20 (b), when a picture with a large bit yield continues, a receive buffer may carry out underflow. That is, supposing the bit yield of the picture decrypted by DTS3 is D3, in DTS3, the prediction accumulated dose of a receive buffer will become less than zero from V3-D3<0. The picture decrypted by DTS3 depends this on not having been inputted into a receive buffer yet. In such a case, he is trying to avoid underflow by enlarging a quantizing scale and decreasing a bit yield.
[0006]As shown in drawing 20 (c), when a picture with a small bit yield continues, a receive buffer may overflow. Namely, the prediction accumulated dose of a receive buffer before decryption of DTS3, It was set to V3 (bit quantity as which =V2*+R and R are inputted into every DTS interval (decoding time interval of one picture) at the receive buffer of a decoding device, bit quantity which in other words is transmitted from coding equipment for every DTS interval), and V3 is over receive buffer capacity. In such a case, he is trying to avoid overflow by making a quantizing scale small and increasing a bit yield.
[0007]However, in order to prevent underflow as mentioned above, when enlarging a quantizing scale and decreasing a bit yield to a degree very much, degradation of image quality will arise. Therefore, the following methods are used together with adjustment of a quantizing scale from the former. The 1st method is a method of using what is called a skip DOMAKU lob lock. At MPEG, coding processing is performed by the macro block unit which is a picture element block of 16x16. A skip DOMAKU lob lock is a macro block which consists of a special code which defined that the same picture as an image comparison should have been displayed in the position, and data volume is very small. Therefore, what is necessary is just to send out a skip DOMAKU lob lock, without coding an original picture, when underflow is likely to be carried out.
[0008]However, in this method, in the position of the macro block which is not a skip DOMAKU lob lock, the portion of an original picture will be displayed, the portion of the picture currently referred to will be displayed in the position of a skip DOMAKU lob lock, and it becomes a picture which is not adjusted as a

whole. Drawing 21 (a) shows the example of the screen usually displayed sometimes.
[0009]Drawing 21 (b) shows the example of the screen displayed when a skip DOMAKU lob lock is used. In the 2nd frame, since the macro block whose macro block of an upper half is not a skip DOMAKU lob lock was used, the original image region of the 2nd frame is displayed, Since the skip DOMAKU lob lock was used, the image region of the 1st frame is displayed and the macro block of a lower half serves as a picture which is not adjusted as a whole.
[0010]The 2nd method is the method of coding pseudo image data. Pseudo image data is image data which is the median in the range which the pixel value can take. For example, the median is set to 128 in expressing a pixel value with 8 bits. In MPEG, since the difference value of the pixel value of image data and the median is coded, the data volume of the coding data of the image data whose picture value is the median is the minimum. Therefore, when underflow is likely to happen for every macro block, a pixel value should just code the image data of the median, without performing original coding.
[0011]However, the picture of a gray color is displayed in the position which made the pixel value the median in this method. Drawing 21 (c) shows the example of the screen displayed when a pseudo image is used. In the 2nd frame, since, as for the macro block of the Johan part, image coding of original was carried out, the original image region of the 2nd frame is displayed, since the macro block of the lower half coded pseudo image data, the picture of a gray color is displayed and it serves as a picture which is not adjusted as a whole.
[0012]By the way, to JP,2871316,B, the method of skipping coding of the 1 field or the whole image data of one frame (it is said hereafter that a picture is skipped.) is indicated. Drawing 22 shows the composition of the video coding device indicated to JP,2871316,B. If the outline of this video numerals device is explained, to the inputted dynamic image data, coding processing will be performed by orthogonal transformation circuit 6 grade, and a picture will be stored in the buffer memory 21. When judged with the transmission rate being over constant value in the transmission rate excess decision circuit 24, the SKIP code in the SKIP code storing memory 22 is outputted, and when judged with the transmission rate not having exceeded, the picture in the buffer memory 20 is outputted.
[0013]As mentioned above, according to this method, when skipping, only some macro blocks of a picture are not considered as a skip DOMAKU lob lock, but all the macro blocks of the remainder except the beginning of the slice layer in a picture and the last are considered as a skip DOMAKU lob lock. By this, in a decoding device, the same picture as the whole picture decrypted in the past will be displayed, and the above mismatching pictures will be displayed.
[0014]
[Problem(s) to be Solved by the Invention]However, the following problems are among the methods indicated to the above-mentioned Patent Gazette. The 1st problem is that the buffer memory 20 which stores temporarily the generated picture as shown in drawing 22 is needed, in order to judge whether the generated amount of pictures is over a transmission rate. Namely, although what was necessary was just to have had the buffer of the small capacity for accumulating the coding data of a macro block unit when it was judged as mentioned above whether it skips for every macro block, In this method, since it judges whether it skips by the whole picture, the mass buffer capacity for storing the code amount of all the macro blocks in a picture is needed.
[0015]When one frame is being assigned to one picture (frame structure), a picture is skipped and the 2nd problem is displayed with an interlace scanning system, it is that a display order may be reversed. Drawing 23 (a) shows the display screen at the time of usual [which does not skip a picture]. 1t and 1b express the top field of the 1st frame, and a bottom field, respectively. In the frame structure, coding processing is made by making into a unit one frame which combined the top field and the bottom field. In this case, in a decoding device, decoding processing is made by making 1 / 1 per 30 seconds into a unit. Since it displays with an interlace system, each field in a frame is displayed every [1/] 60 seconds. That is, it is displayed in order of 1t, 1b, 2t, 2b, and 3t, 3b, 4t and 4b.
[0016]Drawing 23 (b) shows the display screen at the time of being generated by the skip of a picture. In B (3), when generated by skip, the same picture as I (1) which B (3) is referring to is expressed as the frame 2 coded by B (3). Therefore, the top field of the frame 2 becomes the same as 1 t which is a top field of the frame 1, and the bottom field of the frame 2 becomes the same as 1b which is a bottom field of the frame 1. And in order to display with an interlace system, it is displayed every [1/] 60 seconds in order of 1t, 1b, 1t, 1b, 3t, 3b, 4t, and 4b. Thereby, 1 t will be displayed after 1b and a display order will be reversed.
[0017]Then, the purpose of this invention is as follows.
Make unnecessary the special buffer for judging whether the whole picture is skipped.

Even when you skip the whole picture, provide the video coding device which a display order does not reverse.

[0018]
[Means for Solving the Problem]To achieve the above objects, this invention is characterized by that a video coding device which codes image data of one frame or the 1 field comprises the following, predicting an accumulated dose of a receive buffer in a decoding device.
A prediction accumulated dose predicted to probably be accumulated in a receive buffer in decryption time of coding data of the image data concerned before coding image data.
A comparison means to compare a predetermined threshold.
When a prediction accumulated dose is less than a threshold, as data which stops coding of said image data and is taken out from a receive buffer at said decryption time, A skipping means using a proxy code which defined that the image data same instead of coding data of said image data as image data decrypted in the past should have been displayed.

[0019]This invention is characterized by that a video coding device which codes image data of one frame by the frame structure comprises:
A comparison means to compare an accumulated dose of an output buffer, or a prediction accumulated dose of a receive buffer of a decoding device with a predetermined reference value when coding image data.
When judged with said accumulated dose or a prediction accumulated dose having reached a predetermined reference value, Stop coding by the frame structure of said image data, and instead of coding data of a top field of said image data, and a bottom field, A skipping means using a proxy code which defined that the two same fields as a top field or a bottom field which constitutes image data decrypted in the past should have been displayed.

[0020]
[Embodiment of the Invention]Hereafter, an embodiment of the invention is described using a drawing. Before the <1st embodiment> book embodiment generates a picture, it is related with the video coding device which judges whether a picture is skipped by whether the prediction code amount based on the experience value for every picture type is over the prediction accumulated dose of a receive buffer.
(Composition of a video coding device) Drawing 1 shows the composition of the video coding device 100 concerning this embodiment. The video coding device 100 The screen rearranging means 110 and the DCT means 113, The quantization means 114, the rate control means 115, and the variable-length-coding means 116, The buffer 117, the inverse quantization means 119, and the reverse DCT means 120, It comprises the video memory 122, the motion-compensation-prediction means 123, the adding machines 111 and 112, the change machine 118, the receive buffer accumulated dose prediction means 124, the comparison judging means 125, the SKIP picture storing memory 126, and the threshold setting means 127.
[0021]The screen rearranging means 110 is rearranged into an order which codes a screen according to a picture type. Drawing 2 (a) shows an order of a video image from the first, therefore an order displayed with a decoding device. Drawing 2 (b) shows encoding order, therefore an order of being inputted into a decoding device. In order to code using I of order, or the picture of P picture in time, B picture is coded after coding P picture of the future.
[0022]The DCT means 113 performs a discrete cosine transform (DCT) operation by a macro block unit, and outputs a DCT coefficient. Here about I (Intra coded) picture. In intra coding mode, perform DCT operation and about P (Predictive coded) picture and B (Bidirectionally predictive coded) picture. Intra coding mode or motion-compensation-prediction mode is chosen by a macro block unit, and DCT operation is performed. In the case of intra coding mode, DCT operation of the inputted original image is carried out as it is. In the case of motion-compensation-prediction mode, DCT operation of the difference of an original image and the estimated image obtained by the motion-compensation-prediction means 123 is carried out.
[0023]The quantization means 114 makes a quantizing scale change for every macro block, and quantizes a DCT coefficient. The variable-length-coding means 116 carries out variable length coding of the quantized DCT coefficient with a motion vector and coding prediction mode information, and generates the coding data of image data.
[0024]The buffer 117 stores the coding data or the all skip picture of image data by which variable

length coding was carried out. About the decryption picture of I or P picture, since it is necessary to use the inverse quantization means 119 and the reverse DCT means 120 as an image comparison of motion compensation prediction, they restore the decryption picture acquired from the quantized DCT coefficient by performing inverse quantization and reverse DCT, and output it to the video memory 122.

[0025]The video memory 122 stores the decryption picture of I or P picture as an image comparison. The motion-compensation-prediction means 123 outputs an estimated image using the image comparison lost-motion vector stored in the video memory 122 for coding of P or B picture. The rate control means 15 directs change of a quantizing scale to the quantization means 114 according to the prediction accumulated dose of a receive buffer. That is, it is directed to the quantization means 114 that the rate control means 115 will enlarge a quantizing scale if below a constant rate becomes so that a quantizing scale may be made small, if a fixed quantity of prediction accumulated doses of a receive buffer become above.

[0026]The SKIP picture storing memory 126 stores the all skip picture the object for P pictures, and for B pictures. Here, an all skip picture means the picture that all the macro blocks of the remainder except the beginning of the slice layer in 1 picture and the last comprise a skip DOMAKU lob lock. B picture to which all the macro blocks of the remainder except the beginning of a slice layer and the last consist of a skip DOMAKU lob lock instead of B picture and P picture, respectively, P picture (these are called an all skip B picture and an all skip P picture, respectively.) is sent out. I picture is that (a macro block is not made to a skip DOMAKU lob lock.) which cannot be skipped, and an all skip P picture is sent out instead of I picture. If these all skip pictures are sent out instead of the coding data of image data and the coding data of image data says, they will be proxy codes.

[0027]Whenever the receive buffer accumulated dose prediction means 124 outputs one picture, it computes the prediction accumulated dose of the receive buffer before decoding in the decryption time of the following picture. Drawing 3 (a) shows the prediction accumulated dose of the receive buffer at the time of usual [which does not skip a picture]. If the prediction accumulated dose of the receive buffer before decoding in the time of DTSn is set to VBV (n), the bit yield of B picture decrypted at the time of DTSn is set to Db and the amount of transmitted bits for every DTS interval is set to R, VBV (n+1) =VBV(n)-Db+R will be computed.

[0028]Drawing 3 (b) shows the prediction accumulated dose of a receive buffer when a picture is skipped. The prediction accumulated dose of the receive buffer before decoding in the time of DTSn is set to VBV (n), The bit yield of the all skip B picture decrypted at the time of DTSn is set to Dbskip, and if bit quantity transmitted from the coding equipment for every DTS interval is set to R, VBV(n+1) =VBV(n)-Dbskip+R will be computed.

[0029]The threshold setting means 127 sets a threshold (Ti, Tp, Tb1, Tb2), respectively to every picture type (I, P, B1, B-2 picture). Drawing 4 shows the example of setting out of a threshold. Like a following formula, the code amount (prediction code amount) Ei and Ep which are experientially known for every picture type, and Eb are set as the thresholds Ti and Tp, Tb1, and Tb2, respectively.

According to a Ti=EiTp=EpTb1=EbTb2=Eb book embodiment, Ei=400kbit known experientially, Ep=200kbit, and Eb=160kbit shall be used as optimal value in case the resolution of image data is 720 pixels x 480 pixels. Since they have proportionality mostly, the resolution and the prediction code amount of image data should just compute a prediction code amount in proportion to resolution, even when resolution differs from the above.

[0030]It is judged whether the comparison judging means 125 skips coding processing of a picture for the prediction accumulated dose VBV of a receive buffer, and the size of a threshold [before the image data is coded] for every image data. Namely, it judges with the comparison judging means 125 skipping VBV<Ti, when coding the picture as an I picture, It judges with skipping VBV<Tp, in coding the picture as a P picture, In coding the picture as B1 picture, it judges with skipping VBV<Tb1, and in coding the picture as a B-2 picture, it judges with skipping VBV<Tb2.

[0031]Drawing 5 shows an example in case a picture is skipped. In drawing 5 (a), I picture is skipped in DTSn by VBV<Ti. In drawing 5 (b), B1 picture is skipped in DTSn+1 by VBV<Tb1.

[0032]In drawing 5 (c), B-2 picture is skipped in DTSn+2 by VBV<Tb2. In drawing 5 (d), P picture is skipped in DTSn+3 by VBV<Tp. When it judges with the comparison judging means 125 skipping a picture, while stopping coding processing to the DCT means 113, the all skip picture according to a picture type is made to output from the SKIP picture storing memory 126.

[0033]Drawing 6 (a) shows the example of the screen usually displayed with a decoding device. The decryption picture of I (1), B (3), B (4), and P (2) is displayed by the 1st, the 2nd, the 3rd, and the 4th frame, respectively. () An inner number shows an order to code. Drawing 6 (b) shows the example of the

screen displayed with a decoding device, when a picture is skipped. When B (3) picture of the 2nd frame is skipped, although B (3) is using the decryption picture of I (1) and P (2) as the image comparison, by the 2nd frame, the decryption picture of I (1) with a nearer display order is displayed.
(Operation) Next, the operation relevant to the skip processing of the video coding device concerning this embodiment is explained.
[0034]Drawing 7 is a flowchart in which the operation procedures of a video coding device are shown. First, the threshold setting means 127 sets up the thresholds Ti and Tp for a skip judging, Tb1, and Tb2 for every picture type (Step S501). Next, when coding an original image as an I picture, the comparison judging means 125 carries out the comparison test of the size of the prediction accumulated dose VBV of a receive buffer, and threshold Ti. In VBV>=Ti, coding processing is performed for an original image by the DCT means 113, the quantization means 114, and the variable-length-coding means 116 as an I picture (Step S502, S503, S504).
[0035]And the receive buffer accumulated dose prediction means 124 computes the prediction accumulated dose VBV of the receive buffer before the decryption in a following DTS time with the bit yield of I picture and the amount R of transmitted bits for every DTS time interval which were generated (Step S505). And when there is the following image data, processing is continued, and processing will be ended if there is no following image data (Step S506).
[0036]On the other hand, in Step S503, when the comparison judging means 125 judges with VBV<Ti, the comparison judging means 125 compares the size of VBV and Tp further. In VBV>=Tp, when coding processing is made as a P picture and an original image is VBV<Tp, an all skip P picture is outputted from the SKIP picture storing memory 126. And the receive buffer accumulated dose prediction means 124 with the bit yield of an all skip P picture, and the amount R of transmitted bits for every DTS time interval. The prediction accumulated dose VBV of the receive buffer before the decryption in a following DTS time is computed (Step S508, S509, S510, S505).
[0037]When coding an original image as a P picture, the comparison judging means 125 carries out the comparison test of the size of the prediction accumulated dose VBV of a receive buffer, and the threshold Tp. In VBV>=Tp, as usual, when coding processing is made as a P picture and an original image is VBV<Tp, an all skip P picture is outputted from the SKIP picture storing memory 126. With and the bit yield of P picture or the bit yield of an all skip P picture which the receive buffer accumulated dose prediction means 124 generated, and the amount R of transmitted bits for every DTS time interval. The prediction accumulated dose VBV of the receive buffer before the decryption in a following DTS time is computed (Step S507, S508, S509, S510, S505).
[0038]When coding an original image as B1 picture, the comparison judging means 125 carries out the comparison test of the size of the prediction accumulated dose VBV of a receive buffer, and threshold Tb1. In the case of VBV>=Tb1, as usual, when coding processing is made as a B picture and an original image is VBV<Tb1, an all skip B picture is outputted from the SKIP picture storing memory 126. With and the bit yield of B picture or the bit yield of an all skip B picture which the receive buffer accumulated dose prediction means 124 generated, and the amount R of transmitted bits for every DTS time interval. The prediction accumulated dose VBV of the receive buffer before the decryption in a following DTS time is computed (Step S511, S512, S513, S514, S505).
[0039]When coding an original image as a B-2 picture, the comparison judging means 125 carries out the comparison test of the size of the prediction accumulated dose VBV of a receive buffer, and threshold Tb2. In the case of VBV>=Tb2, as usual, when coding processing is made as a B picture and an original image is VBV<Tb2, an all skip B picture is outputted from the SKIP picture storing memory 126. With and the bit yield of B picture or the bit yield of an all skip B picture which the receive buffer accumulated dose prediction means 124 generated, and the amount R of transmitted bits for every DTS time interval. The prediction accumulated dose VBV of the receive buffer before the decryption in a following DTS time is computed (Step S511, S515, S513, S514, S505).
(Conclusion) as mentioned above, in the video coding device concerning this embodiment. It is not judged whether once it generates a picture, a picture is skipped by whether the bit yield is over the prediction accumulated dose of a receive buffer, Since it judges whether a picture is skipped by whether the prediction code amount based on the experience value for every picture type is over the prediction accumulated dose of a receive buffer before generating a picture, The special buffer stored temporarily because of the judgment of whether to skip the generated picture can be made unnecessary.
[0040]As mentioned above, as for this invention, although a 1st embodiment was described, it is needless to say that it is not limited to the above-mentioned embodiment. That is, of course, the following modification is also included in this invention.

(Modification 1) Although the fixed value was used as a threshold, it may be made to decide a threshold in this embodiment according to the complexity for every original image.

[0041]Let P_k (k= 1-64) be a pixel value of the original image within an 8x8-pixel block. If it is the average value E within a block (P_k), it will become $E(P_k)$ =1/64xsigmaP_k. If a variance is set to V (P_k), it will become $V(P_k)$ =1/64xsigma(P_k-E (P_k)) ^{2}.

[0042]It will be set to VAR_j=MIN [V (P_k)] if the minimum of V (P_k) of 8 blocks (4 blocks in frame DCT mode and 4 blocks in field DCT mode) contained in the macro block j is made into VAR_j. It will become act_j=1+VAR_j if the activity of the macro block j is made into act_j.

[0043]It will become ACT=sigma act_j if the activity ACT of an original image is total of the activity of all the macro blocks. Since the complexity within the frame of an original image is high when an activity is a thing reflecting the variance of the pixel value of an original image and its activity is large, it is thought that there are many bit yields of a picture. Therefore, it is possible that what is necessary is just to set up a threshold highly, so that an activity is large.

[0044]It may be made to set up a threshold based on variance. For example, it is considered as VAR=sigma VAR_j, and if it is high in a threshold when VAR is large, and VAR is small, it may be made to set up a threshold low. Not the distribution for every block but distribution of the pixel of the whole picture may be used as variance. That is, if the pixel number of the whole picture is set to N and P_l (l=1-N) is made into the pixel value of an original image, the average value E of the pixel of the whole picture will serve as E=1/Nxsigma P_l, and the variance V of the whole picture will serve as V=1 / Nxsigma (P_l-E (P_l)) ^{2}. And if it is high in a threshold when V is large, and V is small, it may be made to set up a threshold low.

(Modification 2) According to this embodiment, when the prediction code amount for every picture type is over the prediction accumulated dose of a receive buffer, a picture shall be skipped irrespective of picture types. However, since the decryption picture of I picture or P picture is used as an image comparison of other pictures, the skip by I picture or P picture affects other pictures so that it may mention later. Therefore, it is good also as what performs either of whether whether a picture's being skipped and the coding which controlled a code amount which enlarges a quantizing scale, uses only the DC component after DCT, or codes pseudo image data are performed according to a picture type.

[0045]For example, when the prediction code amount is over the prediction accumulated dose of a receive buffer, only in the case of B picture, a picture is skipped, and, in the case of I or P picture, it is good also as what performs the coding which controlled the code amount. Or only in the case of B or P picture, a picture is skipped, and, in the case of I picture, it is good also as what performs the coding which controlled the code amount.

(Modification 3) Although underflow can be almost prevented in this embodiment, In order to prevent underflow thoroughly, when a prediction code amount is larger than the prediction accumulated dose of a receive buffer, As mentioned above, when carrying out underflow of the code amount of the macro block, and the accumulated dose of a receive buffer by a macro block unit as compared with the coding back, it may be made to consider the macro block as a skip DOMAKU lob lock.

The <2nd embodiment> book embodiment is related with the video coding device which the skip made it easy to happen by B picture rather than P or I picture.

(Elements of the Invention) Although the composition of the video coding device concerning this embodiment is common to the video coding device applied in general to a 1st embodiment, the methods of setting out of the threshold by the threshold setting means 127 differ. Hereafter, the setting method of the threshold by the threshold setting means 127 is explained.

[0046]The threshold setting means 127 sets a threshold (Ti, Tp, Tb1, Tb2), respectively to every picture type (I, P, B1, B-2 picture). Drawing 8 shows the example of setting out of a threshold. Like a following formula, Ti and Tp are set as the prediction code amount Ei and Ep like a 1st embodiment.

When it skips by the Ti=EiTp=EpI picture or P picture, B picture which is referring to the skipped picture also becomes the same screen as the skipped picture. In this case, for example, at the time of M(I or appearance cycle of P picture) = 3, four frames becomes the same screen continuously. Therefore, the threshold of B picture is set up more greatly than a 1st embodiment so that a skip may take place by B picture in front of P picture as much as possible.

[0047]Drawing 9 is a figure explaining the threshold of B picture in front of P picture. If VBV (n+1) in the

time of DTSn+1, at the time of DTSn+2, it will become VBV(n+2) =VBV(n+1)-Eb+R. It can be predicted that VBV(n+2) >=Tp does not happen at the time of DTSn+2 in the skip of P picture. If formula modification is carried out, it is necessary to become VBV(n+2) =VBV(n+1)-Eb+R>=Tp=Ep, and to fill the formula of VBV(n+1) >=Eb+ (Ep-R).

[0048]Since it is required like Embodiment 1 to be VBV(n+1) >=Eb, it is necessary to fill the formula of VBV(n+1) >=MAX (Eb, Eb+ (Ep-R)) after all. Therefore, it is referred to as threshold Tb2=MAX (Eb, Eb+ (Ep-R)), and when VBV is less than two Tb, B-2 picture will be skipped and the skip of a prediction top P picture can be prevented from happening at the time of DTSn+1.

[0049]It means that as for this new threshold Tb2 had added Tb2 (quantity equivalent to ** of drawing 9 (Ep-R).) of origin at the time of >=(Ep-R) 0 as shown in drawing 9. At the time of <(Ep-R) 0, threshold Tb2 is still Tb2 of origin. Similarly, at the time of DTSn if VBV (n), at the time of DTSn+2, it will become VBV(n+2) =VBV(n)-Eb+R-Eb+R=VBV(n)-Eb- (Eb-2R). It can be predicted that VBV(n+2) >=Tp does not happen at the time of DTSn+2 in the skip of P picture. If formula modification is carried out, it is necessary to become VBV(n+2) =VBV(n)-Eb-(Eb-2R) >=Tp=Ep, and to fill the formula of VBV(n) >=Eb+ (Ep+Eb-2R) =Eb+(Ep-R)+(Eb-R)=Eb+ (Tb2-R).

[0050]Since it is required like Embodiment 1 to be VBV(n) >=Eb, it is necessary to fill the formula of VBV(n) >=MAX (Eb, Eb+ (Tb2-R)) after all. Therefore, it is referred to as threshold Tb1=MAX (Eb, Eb+ (Tb2-R)), and when VBV is less than one Tb, B1 picture will be skipped and the skip of a prediction top P picture can be prevented from happening at the time of DTSn. It means that as for this new threshold Tb1 had added Tb1 (quantity equivalent to ** of drawing 9 (Ep-R)) of the basis at the time of >=(Tb2-R) 0 as shown in drawing 9 (quantity equivalent to ** of drawing 9 (Eb-R)). At the time of <(Tb2-R) 0, threshold Tb1 is still Tb1 of origin.

[0051]Ep only replaces Ei also about the threshold of B picture in front of I picture, and others are the same. In order to distinguish I picture and P picture, the threshold of B1 picture in front of P picture Tb2 (p), In the threshold of B-2 picture in front of P picture, if the threshold of B-2 picture in front of Tb2(i) and I picture is made into Tb1(i), the following formulas will be materialized [threshold / of B-2 picture in front of Tb1 (p) and I picture].

[0052]

Tb2(p) =MAX (Eb, Eb+ (Ep-R))

Tb1(p) =MAX (Eb, Eb+ (Tb2(p)-R))

Tb2(i)=MAX (Eb, Eb+ (Ei-R))

Tb1(i)=MAX (Eb, Eb+ (Tb2(i)-R))

Drawing 10 (a) shows transition of the prediction accumulated dose of the receive buffer in the threshold in a 1st embodiment. At the time of DTSn and DTSn+1, since VBV becomes at the time of DTSn+2 in less than the threshold Tp, without being generated by the skip of threshold Tb1, Tb2, as mentioned above B picture in the prediction accumulated dose VBV of a receive buffer, it is generated by the skip of P picture.

[0053]Drawing 10 (b) shows transition of the prediction accumulated dose of the receive buffer in the threshold in this embodiment. Since threshold Tb1 was highly set up as shown in the figure, it is generated by the skip of B1 picture when it is DTSn. By this, the prediction accumulated dose VBV of a receive buffer increases, and only the difference (Db1-Dskip) of the bit yield of B1 picture, and the amount of all skip B pictures at the time of DTSn+2. Since the prediction accumulated dose VBV of a receive buffer becomes beyond the threshold Tp, it is not generated by the skip of P picture.

[0054]Drawing 11 (a) shows the example of the screen usually displayed with a decoding device. The decryption picture of I (1), B (3), B (4), and P (2) is displayed by the 1st, the 2nd, the 3rd, and the 4th frame, respectively. () An inner number shows an order to code. Drawing 11 (b) shows the example of the screen displayed with a decoding device, when the skip of a picture is judged with the threshold of a 1st embodiment. In the threshold set up by a 1st embodiment, since the threshold is not set up that it is easy to skip by B picture before P picture, it is easy to generate a skip by P picture. In this case, since P (2) is using the decryption picture of I (1) as the image comparison by having skipped P (2) picture, the decryption picture of I (1) is displayed in the 4th frame. Since B (3) and B (4) are referring to P (2), the 2nd and at least three decryption pictures of I (1) are displayed.

[0055]Drawing 11 (c) shows the example of the screen displayed with a decoding device, when the skip of a picture is generated in the threshold of this embodiment. In the threshold set up by this embodiment, since the threshold is set up that it is easy to skip by B picture before P picture, it is easy to generate a skip by B picture. In this case, although B (3) is using the decryption picture of I (1) and P (2) as the image comparison by having skipped B (3) picture of the 2nd frame, in the 2nd frame, the

decryption picture of I (1) with a nearer display order is displayed. Since there is no picture which is referring to B (3) picture, the decryption picture of other pictures is displayed as usual.

[0056]Drawing 11 (d) shows the example of the screen displayed with a decoding device, when the skip of a picture is generated in the threshold of this embodiment. In this case, although B (4) is using the decryption picture of I (1) and P (2) as the image comparison by having skipped B (4) picture of the 3rd frame, in the 3rd frame, the decryption picture of P (2) with a nearer display order is displayed. Since there is no picture which is referring to B (4) picture, the decryption picture of other pictures is displayed as usual.

(Operation) Operation of the video coding device of this embodiment only differs in operation of a 1st embodiment, and the contents of processing of Step S501 in drawing 7, and others are common. Therefore, explanation of procedure is omitted.

(Conclusion) As mentioned above, since the threshold of B picture is set up highly according to the video coding device concerning this embodiment fulfill the prediction conditions that a skip does not take place by P picture, In usual, even when a skip takes place by P picture, the skip of P picture can be avoided by skipping previously by the last B picture.

(Modification 1) The video coding device of this embodiment, Since it has the original effect which is not in a 1st embodiment of avoiding the skip by P picture, Even if it constitutes so that it may once accumulate in a buffer memory after generating a picture as JP,2871316,B indicates the video coding device of this embodiment, there is a different effect from a Patent Gazette.

[0057]That is, it is good also as what codes image data, generates a picture, once accumulates the picture in a buffer memory, sets up a threshold which avoids the skip by P picture as follows based on the bit yield of the picture, and judges whether it skips or not. Threshold Ti when image data is coded by I picture will be set as a following formula, if the bit yield of the I picture is set to Di.

The threshold Tp when Ti=Di and image data are coded by P picture will be set as a following formula, if the bit yield of the P picture is set to Dp.

[0058]Threshold Tb(i) when Tp=Dp and image data are coded by B picture in front of I picture, If the bit yield of the B picture is set to Db, the prediction code amount of I picture is set to Ei and the amount of transmitted bits per decoding time interval of one picture is set to R, in order to avoid the skip by I picture, it is set as a following formula.

[0059]

Tb(i)=MAX (Db, Db+ (Ei−R))

Threshold Tb (p) when image data is coded by B picture in front of P picture, If the bit yield of the B picture is set to Db, the prediction code amount of P picture is set to Ep and the amount of transmitted bits per decoding time interval of one picture is set to R, in order to avoid the skip by P picture, it is set as a following formula.

[0060]

Tb(p) =MAX (Db, Db+ (Ep−R))

(Modification 2) Drawing 12 shows the example of setting out of other thresholds. Like a following formula in Ti, Tp, Tb2 (p), and Tb2(i), the same value as a 2nd embodiment is set up.

[0061]Ti=EiTp=EpTb2(p) =MAX (Eb, Eb+ (Ep−R))

Tb2(i)=MAX (Eb, Eb+ (Ei−R))

According to a 2nd embodiment, since the threshold of B1 picture is set up highly as mentioned above, it is easy to generate a skip. However, when the actual bit yield of B1, B−2, and P picture is smaller than the amount of prediction, even if it does not skip by B1 picture, the skip of P picture may not take place. Therefore, it is desirable at the point of avoiding the skip it is more nearly unnecessary to confirm whether it waiting and skipping as much as possible till B−2 picture in front of P picture.

[0062]On the other hand, even if it judges with waiting and skipping till B−2 picture, when there are quite few prediction accumulated doses of a receive buffer, the skip of P picture may be unable to be avoided only by skipping B−2 picture. Therefore, even if it skips B1 picture by B−2 picture, it decides to restrict moreover, when a skip takes place by P picture, and to skip, and sets up the threshold of B1 picture for it.

[0063]Drawing 13 is a figure explaining the threshold of B picture in front of P picture. At the time of DTSn if VBV (n), at the time of DTSn+2, it will become VBV(n+2) =VBV(n)−Eb+R−Dbskip+R=VBV(n)−Eb−(Dbskip−2R). Here, Dbskip is a bit yield of an all skip B picture. If it is VBV(n+2) >=Tp, the skip of P picture will not take place in the time of DTSn+2. If formula modification is carried out, it is necessary to become VBV(n+2) =VBV(n)−Eb−(Dbskip−2R) >=Tp=Ep, and to fill the formula of VBV(n) >=Eb+(Ep+Dbskip−2R) =Eb+(Ep−R)+(Dbskip−R)=Dbskip+ (Tb2−R).

[0064]Since it is required like Embodiment 1 to be VBV(n) >=Eb, it is necessary to fill the formula of VBV(n) >=MAX (Eb, Dbskip+ (Tb2-R)) after all. Therefore, it is referred to as threshold Tb1=MAX (Eb, Dbskip+ (Tb2-R)), and when VBV is less than one Tb, B1 picture will be skipped and the skip of a prediction top P picture can be prevented from happening at the time of DTSn.
[0065]this shows drawing 13 at the time of Dbskip+(Tb2-R) >=Eb -- as -- new threshold Tb1 -- Tb1 (quantity equivalent to ** of drawing 13 (Ep-R)) of a basis -- adding (quantity equivalent to ** of drawing 13 (R-Dbskip)) -- it means reducing At the time of Dbskip+(Tb2-R) <Eb, threshold Tb1 is still Tb1 of origin.
[0066]Ep only replaces Ei also about the threshold of B picture in front of I picture, and others are the same. Therefore, the following formulas are materialized.
Tb1(p) =MAX (Eb, Dbskip+ (Tb2(p)-R))
Tb1(i)=MAX (Eb, Dbskip+ (Tb2(i)-R))
When one frame is being assigned to one picture (frame structure) and coding of image data is skipped, the <3rd embodiment> book embodiment is related with the video coding device which a display order does not reverse, even if it displays with an interlace scanning system.
(Elements of the Invention) The composition of the video coding device concerning this embodiment is common in general. Hereafter, a different point is explained.
[0067]A screen rearranging means rearranges image data per frame. The DCT means 113 is coding the image data of the frame unit. When the prediction accumulated dose of a receive buffer is less than a threshold, the comparison judging means 125 makes the DCT means 113 stop coding processing of the image data of the following frame, and makes an all skip picture output from the SKIP picture storing memory 126 like a 1st embodiment.
[0068]The all skip picture P picture of a field structural steel worker and all skip B picture which make a reference destination a forward's (a display order is the point) bottom field or top field [being backward (a display order. after)] are stored in a SKIP picture storing memory. In these all skip pictures, what makes a reference destination the field where a display order is the nearest is chosen as the field of the skipped image data by the comparison judging means 125, and is sent out to it.
[0069]Drawing 14 shows the picture header of the picture layer of an all skip B picture, and picture encoding extension. As shown in ** of the figure, picture structure is specified as the top field. Drawing 15 shows the field referred to in the case of skipping the frame 2. Drawing 15 (a) shows the case of M(I or appearance cycle of P picture) = 1. Since the frame 2 is P picture, the field usable as a reference field is set to 1t and 1b. Among these, since both 2 t and 2b have a display order close to 1b, 1b becomes a reference field of 2 t and 2b.
[0070]Therefore, originally, when coding 1t and 1b, the all skip P picture which makes the forward's bottom field the reference destination is outputted. Drawing 15 (b) shows the case of M(I or appearance cycle of P picture) = 2. Since the frame 2 is B picture, the field usable as a reference field is set to 1t, 1b, 3t, and 3b. Since a display order is close to 1b, 2 t 1b becomes a reference field which is 2t. Since the display order of 2b is close to 3 t, 3 t becomes a reference field of 2b.
[0071]Therefore, originally, when coding 2 t, the all skip B picture which makes the forward's bottom field the reference destination is outputted. Therefore, originally, when coding 2b, the all skip B picture which makes the backward top field the reference destination is outputted. Drawing 15 (c) shows the case of M(I or appearance cycle of P picture) = 3. Since the frame 2 is B picture, the field usable as a reference field is set to 1t, 1b, 4t, and 4b. Since 2 t and 2b have 1b and the near display order, 1b becomes a reference field.
[0072]Therefore, originally, when coding 2 t and 2b, the all skip B picture which makes the forward's bottom field the reference destination, respectively is outputted. Drawing 16 shows the field referred to in the case of skipping the frame 3. Drawing 16 (a) shows the case of M(I or appearance cycle of P picture) = 1. Since the frame 3 is P picture, the field usable as a reference field serves as 2 t and 2b. Among these, since both 3t and 3b have a display order close to 2b, 2b becomes a reference field of 3t and 3b.
[0073]Therefore, originally, when coding 3t and 3b, the all skip P picture which makes the forward's bottom field the reference destination is outputted. Drawing 16 (b) shows the case of M(I or appearance cycle of P picture) = 2. Since the frame 3 is P picture, the field usable as a reference field is set to 1t and 1b. Among these, since both 3t and 3b have a display order close to 1b, 1b becomes a reference field of 3t and 3b.
[0074]Therefore, originally, when coding 3t and 3b, the all skip P picture which makes the forward's bottom field the reference destination is outputted. In order that 2 t and 2b may also prevent the

inversion of a display order by displaying 1b at the time of 3 t, 2 t and 2b set a reference field to 1b, and perform skip processing. The all skip picture which makes the forward's bottom field the reference destination also in this case is outputted.

[0075]Drawing 16 (c) shows the case of M(I or appearance cycle of P picture) = 3. Since the frame 3 is B picture, the field usable as a reference field is set to 1b, 1t, 4t, and 4b. Among these, since 3t and 3b have a display order close to 4 t, 4 t becomes a reference field of 3t and 3b. Therefore, the all skip B picture which makes the backward top field the reference destination is outputted.

[0076]Drawing 17 shows the reference field in the case of skipping the frame 4 in the case of M(I or appearance cycle of P picture) = 3. Since the frame 4 is P picture, the field usable as a reference field is set to 1t and 1b. Among these, since both 4t and 4b have a display order close to 1b, 1b becomes a reference field of 4t and 4b.

[0077]Therefore, originally, when coding 4t and 4b, the all skip P picture which makes the forward's bottom field the reference destination is outputted. In order that 2 t, 2b, and 3t and 3b may also prevent the inversion of a display order by displaying 1b at the time of 4 t, 2 t, 2b, and 3t and 3b set a reference field to 1b, and perform skip processing. The all skip picture which makes the forward's bottom field the reference destination also in this case is outputted.

(Operation) To the next Operation of the video coding device concerning this embodiment is explained.

[0078]Drawing 18 and drawing 19 are flowcharts in which the operation procedures in M(I or appearance cycle of P picture) = 3 in the video coding device concerning this embodiment are shown. Setting out (S501) of a threshold, and the judgment of whether to skip (S502, S503, S507, S508, S511, S512, S515), Since operation of the coding processing (S504) as an I picture, the coding processing (S509) as a P picture, and the coding processing (S513) as a B picture is the same as that of a 1st embodiment, explanation is omitted.

[0079]Since this embodiment differs in the skip method of the picture shown in S801-S810 from a 1st embodiment, it explains these steps. According to this embodiment, since the frame structure is changed to field structure when skipping, two all skip pictures of the top field and bottom field for one screen are outputted. That is, the skip of a picture is performed twice.

[0080]In the case of VBV<Tb1, in Step S512, the all skip B picture which makes a forward's bottom field a reference destination is twice outputted in Step S807 and Step S808. (Refer to drawing 15 (c) for the example of a reference destination). In the case of VBV<Tb2, in Step S515, the all skip B picture which makes a backward top field a reference destination is twice outputted in Step S809 and Step S810. (Refer to drawing 16 (c) for the example of a reference destination).

[0081]In VBV<Tp, in Step S508, the all skip P picture which makes a forward's bottom field a reference destination is twice outputted in Steps S801 and S802 (refer to drawing 17 for the example of a reference destination). And in Steps S803-S806, the all skip B picture which makes a forward's bottom field a reference destination is outputted instead of B picture between skipped P picture and I picture of the reference destination, respectively (refer to drawing 17 for the example of a reference destination).

[0082]And the bit yield of the bit yield of the picture which the receive buffer accumulated dose prediction means 124 generated in Step S505, two pieces, or six all skip pictures, The prediction accumulated dose VBV of the receive buffer before the decryption in a following DTS time is computed with the amount R of transmitted bits for every DTS time interval.

(Conclusion) According to the video coding device applied to this embodiment as mentioned above. When one frame is being assigned to one picture (frame structure) and the prediction accumulated dose of a receive buffer becomes less than a threshold, Since the all skip picture of the field structure which stopped the coding by the frame structure of image data, and made the reference destination the field where a display order is the nearest is sent out, Even if it displays with an interlace scanning system, a display order can be prevented from reversing, when coding of image data is skipped.

(Modification) Although it judged whether a picture would be skipped or not in the video coding device concerning this embodiment based on the prediction accumulated dose of a receive buffer, it does not limit to this. For example, it is good also as what judges whether a picture is skipped or not based on the accumulated dose of the output buffer by the side of a video coding device.

[0083]

[Effect of the Invention]To achieve the above objects, this invention is characterized by that the video coding device which codes the image data of one frame or the 1 field comprises the following, predicting the accumulated dose of the receive buffer in a decoding device.

The prediction accumulated dose predicted to probably be accumulated in the receive buffer in the decryption time of the coding data of the image data concerned before coding image data.

A comparison means to compare a predetermined threshold.
When a prediction accumulated dose is less than a threshold, as data which stops coding of said image data and is taken out from a receive buffer at said decryption time, The skipping means using the proxy code which defined that the image data same instead of the coding data of said image data as the image data decrypted in the past should have been displayed.

[0084]Since it judges by this whether coding is stopped or not before coding image data, in order to judge whether the prediction accumulated dose of a receive buffer becomes in less than a threshold, the special buffer for accumulating the coding data of image data temporarily can be made unnecessary. Here, ************** which is said video coding device and sets a threshold further to every [of the picture by which image data is coded] type (I picture, P picture, or B picture) is included.
[0085]since encoding methods differed for every I picture, P picture, and B picture and the orders of the code amount also differed by this, it responded to the picture type -- a threshold can be set up appropriately. When a picture type is B picture, here said skipping means, All the macro blocks of the remainder except the beginning of a slice layer and the last use the all skip B picture which is a B picture which comprises a skip DOMAKU lob lock as a proxy code, When a picture type is I or P picture, all the macro blocks of the remainder except the beginning of a slice layer and the last use the all skip P picture which is a P picture which comprises a skip DOMAKU lob lock as a proxy code.
[0086]Thereby, the proxy code which defined that the same image data as the image data decrypted in the past should have been displayed can be created using the skip DOMAKU lob lock of MPEG. Here, the threshold of said threshold setting means is characterized by being a prediction code amount. Thereby, since the prediction code amount of the picture for every picture type of I, P, and B is set as a threshold, the underflow of a receive buffer can be prevented with high precision.
[0087]Here, said threshold setting means computes the variance of a pixel value for every image data, and a bigger threshold is set up, so that the variance concerned is large. Since the code amount of the image data generally becomes large by this so that the variance of the pixel of image data is large, the underflow of a receive buffer can be prevented more to high degree of accuracy by setting up a big threshold by the big image data of a variance.
[0088]Said threshold setting means makes VAR_j the minimum of the variances of the pixel value of the image data in each 8 blocks (4 blocks in frame DCT mode, and 4 blocks in field DCT mode) block included in the macro block j here, When the activity of the macro block j is made into act_j, it is considered as $act_j=1+VAR_j$ and the activity ACT of image data is considered as total of the activity of all the macro blocks, A bigger threshold is set up as a picture with the big activity ACT of image data.
[0089]Since the code amount of the image data generally becomes large by this so that the activity of image data is large, the underflow of a receive buffer can be prevented more to high degree of accuracy by setting up a big threshold by image data with a big activity. Here, said threshold setting means sets each prediction code amount as a threshold about I or P picture, and sets a bigger value than the prediction code amount of B picture as a threshold about B picture.
[0090]the threshold of B picture is set up by this more highly than a prediction code amount -- B picture, since it becomes easy to skip, The same picture can be prevented from the skip by I or P picture referred to at other pictures being able to take place, being able to ****, and as a result being displayed continuously repeatedly. Here said threshold setting means in the case of M (I or appearance cycle of P picture)>=2, For the prediction code amount of Ei and P picture, when the amount of transmitted bits per decoding time interval of Eb and one picture is set to R for the prediction code amount of Ep and B picture, the prediction code amount of I picture, If threshold Ti=Ei of I picture, threshold Tp=Ep of P picture, and encoding order make Tb(i) the threshold of B picture in front of I picture, If encoding order sets the threshold of B picture in front of P picture to Tb (p) at the time of Tb (i)=Eb <(Ei−R) 0 the time of Tb(i)=Eb+(Ei−R) (Ei−R)>=0, It is considered as the time of Tb(p) =Eb <(Ep−R) 0 the time of Tb(p) =Eb+(Ep−R) (Ep−R)>=0.
[0091]Thereby, based on the prediction code amount of I or P picture, the threshold of B picture in front of I or P picture can be set up so that a skip may not take place by I or P picture. Here said threshold setting means in the case of M (I or appearance cycle of P picture)>=3, For the prediction code amount of Ei and P picture, when the amount of transmitted bits per decoding time interval of Eb and one picture is set to R for the prediction code amount of Ep and B picture, the prediction code amount of I picture, If threshold Ti=Ei of I picture, threshold Tp=Ep of P picture, and encoding order make Tb2(i) the threshold of B picture (B−2(i)) in front of I picture, the time of Tb2(i)=Eb+(Ei−R) (Ei−R)

>=0 -- the time of Tb2(i)=Eb <(Ei-R) 0 -- encoding order -- B-2(i), if the threshold of the last B picture (B1(i)) is made into Tb1(i), At the time of Tb1(i)=Eb+(Tb2(i)-R) (Tb2(i)-R) >=0. If encoding order sets the threshold of B picture (B-2 (p)) in front of P picture to Tb2 (p) at the time of Tb1(i)=Eb <(Tb2(i)-R) 0, If encoding order sets the threshold of B picture (B1 (p)) in front of B-2 (p) to Tb1 (p) at the time of Tb2 (p) =Eb <(Ep-R) 0 the time of Tb2(p) =Eb+(Ep-R) (Ep-R)>=0, It is considered as the time of Tb1(p) =Eb <(Tb2(p)-R) 0 at the time of Tb1(p) =Eb+(Tb2(p)-R) (Tb2(p)-R) >=0.

[0092]Thereby, based on the prediction code amount of I or P picture, the threshold of B picture in front of I or P picture and B picture in front of the B picture concerned can be set up so that a skip may not take place by I or P picture. Here, as for said threshold setting means, at the time of M (I or appearance cycle of P picture)>=3, encoding order is higher than the threshold of B picture (B1) in front of the B picture (B-2) concerned, and encoding order sets up the threshold of B picture (B-2) in front of I picture.

[0093]By this the skip of B picture for avoiding the skip by I or P picture, A time [the uncertainty of whether it can be made easy to happen just before I or P picture, and a skip is required of I or P picture is high], That is, when predicting the accumulated dose of the receive buffer of the decryption time of P picture based on many prediction items, the skip by unnecessary B picture is avoidable.

[0094]Here said threshold setting means in the case of M (I or appearance cycle of P picture)>=3, For the prediction code amount of Ei and P picture, when the amount R of transmitted bits per decoding time interval of Eb and one picture and the code amount of an all skip B picture are set to Dbskip for the prediction code amount of Ep and B picture, the prediction code amount of I picture, If threshold Ti=Ei of I picture, threshold Tp=Ep of P picture, and encoding order consider it as threshold Tb2(i) of B picture (B-2(i)) in front of I picture, the time of Tb2(i)=Eb+(Ei-R) (Ei-R)>=0 -- the time of Tb2(i)=Eb < (Ei-R) 0 -- encoding order -- B-2(i) -- if the threshold of the last B picture (B1(i)) is made into Tb1(i) -- Tb1(i)=Dbskip+ (Tb2(i)-R)

If encoding order sets the threshold of B picture (B-2 (p)) in front of P picture to Tb2 (p) at the time of Tb1(i)=EbDbskip+(Tb2(i)-R) <Eb at the time of Dbskip+(Tb2(i)-R) >=Eb, It is Tb2 (p) the time of Tb2(p) =Eb+(Ep-R) (Ep-R)>=0. When encoding order sets the threshold of B picture (B1 (p)) in front of B-2 (p) to Tb1 (p) at the time of =Eb <(Ep-R) 0, it is Tb1(p) =Dbskip+ (Tb2(p)-R).

It is considered as the time of Tb1(p) =EbDbskip+(Tb2(p)-R) <Eb at the time of Dbskip+(Tb2(p)-R) >=Eb.

[0095]Since it restricts to the time when it skips by B-2 picture and B1 picture is also skipped by this in order to avoid the skip by I or P picture, When the uncertainty of whether a skip is required of I or P picture is high (i.e., when predicting the accumulated dose of the receive buffer of the decryption time of P picture based on many prediction items), the skip by B1 unnecessary picture is avoidable.

[0096]In [this invention is a video coding device which codes the image data of one frame or the 1 field while predicting the accumulated dose of the receive buffer in a decoding device, and] after coding of image data, According to a picture type, threshold Ti when image data is coded by I picture in the case of M (I or appearance cycle of P picture)>=2, Threshold Ti when the code amount of the I picture concerned was set to Di, it is set as Ti=Di and image data is coded by P picture, If the code amount of the P picture concerned is set to Dp, will set it as Tp=Dp and encoding order threshold Tb(i) when image data is coded by B picture in front of I picture, If the code amount of the B picture is set to Db, the prediction code amount of I picture is set to Ei and the amount of transmitted bits per decoding time interval of one picture is set to R, The time of Tb(i)=Db+(Ei-R) (Ei-R)>=0 At the time of Tb(i)=Db < (Ei-R) 0. It is alike and set up, and threshold Tb (p) when image data is coded by B picture in front of P picture sets the code amount of the B picture to Db, and encoding order sets the prediction code amount of P picture to Ep, When the amount of transmitted bits per decoding time interval of one picture is set to R, at the time of Tb(p) =Db+(Ep-R) (Ep-R)>=0. In after the threshold setting means set up without the time of Tb(p) =Db <(Ep-R) 0, and the numerals of image data, When it is probably accumulated in the receive buffer in the decryption time of the coding data of the image data, a prediction accumulated dose, A comparison means to compare said set-up threshold, and when a prediction accumulated dose is less than a threshold, It had the skipping means using the proxy code which defined that the image data same instead of the coding data of said image data taken out from a receive buffer at said decryption time as the image data decrypted in the past should have been displayed.

[0097]Since a threshold is always set up by this not more than the prediction code amount of a picture but more than a actual code amount while a skip makes it hard to happen by I or P picture, the underflow of a receive buffer can be prevented certainly. This invention is characterized by that the

video coding device which codes the image data of one frame by the frame structure comprises:
A comparison means to compare the accumulated dose of an output buffer, or the prediction accumulated dose of the receive buffer of a decoding device with a predetermined reference value when coding image data.
When judged with said accumulated dose or the prediction accumulated dose having reached the predetermined reference value, Stop the coding by the frame structure of said image data, and instead of the coding data of the top field of said image data, and a bottom field, The skipping means using the proxy code which defined that the two same fields as the top field or bottom field which constitutes the image data decrypted in the past should have been displayed.

[0098]By this, when skipping coding of image data, How to assign a picture changes to field structure, and each field of the skipped image data, Since it can be referred to [a top field, a bottom field, or], even when it skips, the situation which a display order reverses can be prevented by maintaining the frame structure.
[0099]the top field where said skipping means constitutes here the image data decrypted in the past -- moreover -- and among bottom fields, A display order uses the proxy code which defined that the two same fields as the nearest field should have been displayed for each field of the image data which stopped the coding by said frame structure.
[0100]By this each field of the image data which skipped coding, Since a display order cannot become behind rather than the reference destination field of the bottom field of the image data which the reference destination field of the top field of the image data which skipped coding skipped since the nearest field of the display order was made into the reference destination field, The inversion of a display order is certainly avoidable.
[0101]When the type of a picture with which said image data which stopped the coding by the frame structure was due to be coded is B picture, here said skipping means, All the macro blocks of the remainder except the beginning of a slice layer and the last use as said proxy code two of the all skip B pictures which are B pictures which comprise a skip DOMAKU lob lock, When the type of a picture with which said image data which stopped the coding by the frame structure was due to be coded is I or P picture, All the macro blocks of the remainder except the beginning of a slice layer and the last use as said proxy code two of the all skip P pictures which are P pictures which comprise a skip DOMAKU lob lock.
[0102]Thereby, the proxy code which defined that the same image data as the image data decrypted in the past should have been displayed can be created using the skip DOMAKU lob lock of MPEG. By said all skip P picture used when the type of a picture with which said image data which stopped the coding by the frame structure was due to be coded is I or P picture, here said skipping means. A display order makes a reference field the bottom field of the image data of I used as the point, or P picture, In said all skip B picture which is used in the case of B picture (B1) by which the type of a picture with which said image data which stopped the coding by the frame structure was due to be coded is coded just behind I or P picture. A display order makes a reference field the bottom field of the image data of I used as the point, or P picture, In said all skip B picture which is used in the case of B picture (B-2) by which the type of a picture with which said image data which stopped the coding by the frame structure was due to be coded is coded just before I or P picture. A display order makes a reference field the top field of the image data of I which becomes the back, or P picture.
[0103]Since the all skip picture which specified the suitable reference field is chosen by this according to a picture type, the inversion of a display order is simply and appropriately avoidable. When the type of a picture with which said image data which stopped the coding by the frame structure was due to be coded is I or P picture, here said skipping means, Coding of the image data coded by B picture after that is stopped, and a display order uses two of the all skip B pictures which made the previous bottom field the reference field instead of the coding data of the top field of the image data concerned, and a bottom field.
[0104]By this, when generated by skip in P or I picture, The field of the image data of B picture which refers to it and which is doing things can also prevent the inversion of a display order by making the field as the field made into the reference destination where the field of the skipped image data is the same into the reference destination field. This invention is characterized by that the video coding device which codes the image data of one frame or the 1 field comprises the following, predicting the accumulated dose of the receive buffer in a decoding device.
The prediction accumulated dose predicted to probably be accumulated in the receive buffer in the

decryption time of the coding data of the image data concerned before coding image data.
A comparison means to compare the threshold for every picture type by which image data is coded.
When the type of a picture with which it is a case where a prediction accumulated dose is less than a threshold, and said image data is coded is B picture, The control means using the proxy code which defined that the image data same instead of the coding data of said image data which stops coding of said image data and is taken out from a receive buffer at said decryption time as the image data decrypted in the past should have been displayed.

[0105]Since the prediction accumulated dose of a receive buffer restricts less than a threshold in the case of B picture and skips a picture by this, About I or P picture referred to at other pictures, the number of times as which the same picture is continuously displayed by performing the coding which controlled the code amount etc. can be lessened. This invention is characterized by that the video coding device which codes the image data of one frame or the 1 field comprises the following, predicting the accumulated dose of the receive buffer in a decoding device.
The prediction accumulated dose predicted to probably be accumulated in the receive buffer in the decryption time of the coding data of the image data concerned before coding image data.
A comparison means to compare the threshold for every picture type by which image data is coded.
When the type of a picture with which it is a case where a prediction accumulated dose is less than a threshold, and said image data is coded is B or P picture, The control means using the proxy code which defined that the image data same instead of the coding data of said image data which stops coding of said image data and is taken out from a receive buffer at said decryption time as the image data decrypted in the past should have been displayed.

[0106]Since the prediction accumulated dose of a receive buffer restricts less than a threshold in the case of B or P picture and skips a picture by this, about I picture referred to at other pictures, the frequency where the same picture is continuously displayed by performing the coding which controlled the code amount etc. can be reduced. This invention is characterized by that the video coding method which codes the image data of one frame or the 1 field comprises the following, predicting the accumulated dose of the receive buffer in a decoding device.
The prediction accumulated dose predicted to probably be accumulated in the receive buffer in the decryption time of the coding data of the image data concerned before coding image data.
The step which compares a predetermined threshold.
When a prediction accumulated dose is less than a threshold, as data which stops coding of said image data and is taken out from a receive buffer at said decryption time, The step using the proxy code which defined that the image data same instead of the coding data of said image data as the image data decrypted in the past should have been displayed.

[0107]Since it judges by this whether coding is stopped or not before coding image data, in order to judge whether the prediction accumulated dose of a receive buffer becomes in less than a threshold, the special buffer for accumulating the coding data of image data temporarily can be made unnecessary. This invention is characterized by that the video coding method which codes the image data of one frame by the frame structure comprises:
The step which compares the accumulated dose of an output buffer, or the prediction accumulated dose of the receive buffer of a decoding device with a predetermined reference value when coding image data.
When judged with said accumulated dose or the prediction accumulated dose having reached the predetermined reference value, Stop the coding by the frame structure of said image data, and instead of the coding data of the top field of said image data, and a bottom field, The step using the proxy code which defined that the two same fields as the top field or bottom field which constitutes the image data decrypted in the past should have been displayed.

[0108]By this, when skipping coding of image data, How to assign a picture changes to field structure, and each field of the skipped image data, Since it can be referred to [a top field, a bottom field, or], even when it skips, the situation which a display order reverses can be prevented by maintaining the frame structure.
[0109]The video coding program of this invention, predicting the accumulated dose of the receive buffer in a decoding device. In order to code the image data of one frame or the 1 field a computer, The

prediction accumulated dose predicted to probably be accumulated in the receive buffer in the decryption time of the coding data of the image data concerned before coding image data, A comparison means to compare a predetermined threshold, and when a prediction accumulated dose is less than a threshold, Coding of said image data is stopped and it is made to function as a skipping means using the proxy code which defined that the image data same instead of the coding data of said image data as data taken out from a receive buffer at said decryption time as the image data decrypted in the past should have been displayed.

[0110]Since it judges by this whether coding is stopped or not before coding image data, in order to judge whether the prediction accumulated dose of a receive buffer becomes in less than a threshold, the special buffer for accumulating the coding data of image data temporarily can be made unnecessary. In order that the video coding program of this invention may code the image data of one frame by the frame structure, a computer, A comparison means to compare the accumulated dose of an output buffer, or the prediction accumulated dose of the receive buffer of a decoding device with a predetermined reference value when coding image data, When judged with said accumulated dose or the prediction accumulated dose having reached the predetermined reference value, Stop the coding by the frame structure of said image data, and instead of the coding data of the top field of said image data, and a bottom field, It is made to function as a skipping means using the proxy code which defined that the two same fields as the top field or bottom field which constitutes the image data decrypted in the past should have been displayed.

[0111]By this, when skipping coding of image data, How to assign a picture changes to field structure, and each field of the skipped image data, Since it can be referred to [a top field, a bottom field, or], even when it skips, the situation which a display order reverses can be prevented by maintaining the frame structure.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention]Especially this invention relates to the video coding device which skips coding of image data and adjusts a code amount about a video coding device.

[Translation done.]

PRIOR ART

[Description of the Prior Art]The code amount is controlled by video coding based on an MPEG standard, predicting the accumulated dose of the picture of the receive buffer of a decoding device. This is called code quantity control by a VBV (Video Buffering Verifier) model.
[0003]Drawing 20 (a) shows the transition at the time of usual [of the prediction accumulated dose of a receive buffer]. As shown in the figure, a picture is inputted into a receive buffer at a fixed rate. And since one picture is decryption, it is outputted to the time shown by DTS (Decoding Time Stamp) from a receive buffer. When a decoding device has an indicator of NTSC system, DTS assigns one frame to one picture and the 1 field is assigned to one picture every [1/] 30 seconds, it is set up every [1/] 60 seconds. When a decoding device has an indicator of a PAL system, DTS assigns one frame to one picture and the 1 field is assigned to one picture every [1/] 25 seconds, it is set up every [1/] 50 seconds.
[0004]Usually, as shown in drawing 20 (a) at the time, supposing the bit yield of the picture decrypted by DTS1 is D1, in DTS1, the prediction accumulated dose of a receive buffer will decrease to V1 to $V1^*$ ($=V1-D1$). A code amount is controlled by a VbV model so that the prediction accumulated dose of a receive buffer causes neither overflow nor underflow.
[0005]At the times, such as a scene change, like drawing 20 (b), when a picture with a large bit yield continues, a receive buffer may carry out underflow. That is, supposing the bit yield of the picture decrypted by DTS3 is D3, in DTS3, the prediction accumulated dose of a receive buffer will become less than zero from $V3-D3<0$. The picture decrypted by DTS3 depends this on not having been inputted into a receive buffer yet. In such a case, he is trying to avoid underflow by enlarging a quantizing scale and decreasing a bit yield.
[0006]As shown in drawing 20 (c), when a picture with a small bit yield continues, a receive buffer may overflow. Namely, the prediction accumulated dose of a receive buffer before decryption of DTS3, It was set to V3 (bit quantity as which $=V2^*+R$ and R are inputted into every DTS interval (decoding time interval of one picture) at the receive buffer of a decoding device, bit quantity which in other words is transmitted from coding equipment for every DTS interval), and V3 is over receive buffer capacity. In such a case, he is trying to avoid overflow by making a quantizing scale small and increasing a bit yield.
[0007]However, in order to prevent underflow as mentioned above, when enlarging a quantizing scale and decreasing a bit yield to a degree very much, degradation of image quality will arise. Therefore, the following methods are used together with adjustment of a quantizing scale from the former. The 1st method is a method of using what is called a skip DOMAKU lob lock. At MPEG, coding processing is performed by the macro block unit which is a picture element block of 16x16. A skip DOMAKU lob lock is a macro block which consists of a special code which defined that the same picture as an image comparison should have been displayed in the position, and data volume is very small. Therefore, what is necessary is just to send out a skip DOMAKU lob lock, without coding an original picture, when underflow is likely to be carried out.
[0008]However, in this method, in the position of the macro block which is not a skip DOMAKU lob lock, the portion of an original picture will be displayed, the portion of the picture currently referred to will be displayed in the position of a skip DOMAKU lob lock, and it becomes a picture which is not adjusted as a whole. Drawing 21 (a) shows the example of the screen usually displayed sometimes.
[0009]Drawing 21 (b) shows the example of the screen displayed when a skip DOMAKU lob lock is used. In the 2nd frame, since the macro block whose macro block of an upper half is not a skip DOMAKU lob lock was used, the original image region of the 2nd frame is displayed, Since the skip DOMAKU lob lock was used, the image region of the 1st frame is displayed and the macro block of a lower half serves as a

picture which is not adjusted as a whole.
[0010]The 2nd method is the method of coding pseudo image data. Pseudo image data is image data which is the median in the range which the pixel value can take. For example, the median is set to 128 in expressing a pixel value with 8 bits. In MPEG, since the difference value of the pixel value of image data and the median is coded, the data volume of the coding data of the image data whose picture value is the median is the minimum. Therefore, when underflow is likely to happen for every macro block, a pixel value should just code the image data of the median, without performing original coding.
[0011]However, the picture of a gray color is displayed in the position which made the pixel value the median in this method. Drawing 21 (c) shows the example of the screen displayed when a pseudo image is used. In the 2nd frame, since, as for the macro block of the Johan part, image coding of original was carried out, the original image region of the 2nd frame is displayed, since the macro block of the lower half coded pseudo image data, the picture of a gray color is displayed and it serves as a picture which is not adjusted as a whole.
[0012]By the way, to JP,2871316,B, the method of skipping coding of the 1 field or the whole image data of one frame (it is said hereafter that a picture is skipped.) is indicated. Drawing 22 shows the composition of the video coding device indicated to JP,2871316,B. If the outline of this video numerals device is explained, to the inputted dynamic image data, coding processing will be performed by orthogonal transformation circuit 6 grade, and a picture will be stored in the buffer memory 21. When judged with the transmission rate being over constant value in the transmission rate excess decision circuit 24, the SKIP code in the SKIP code storing memory 22 is outputted, and when judged with the transmission rate not having exceeded, the picture in the buffer memory 20 is outputted.
[0013]As mentioned above, according to this method, when skipping, only some macro blocks of a picture are not considered as a skip DOMAKU lob lock, but all the macro blocks of the remainder except the beginning of the slice layer in a picture and the last are considered as a skip DOMAKU lob lock. By this, in a decoding device, the same picture as the whole picture decrypted in the past will be displayed, and the above mismatching pictures will be displayed.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention]To achieve the above objects, this invention, predicting the accumulated dose of the receive buffer in a decoding device. It is a video coding device which codes the image data of one frame or the 1 field, The prediction accumulated dose predicted to probably be accumulated in the receive buffer in the decryption time of the coding data of the image data concerned before coding image data, A comparison means to compare a predetermined threshold, and when a prediction accumulated dose is less than a threshold, As data which stops coding of said image data and is taken out from a receive buffer at said decryption time, It had the skipping means using the proxy code which defined that the image data same instead of the coding data of said image data as the image data decrypted in the past should have been displayed.
[0084]Since it judges by this whether coding is stopped or not before coding image data, in order to judge whether the prediction accumulated dose of a receive buffer becomes in less than a threshold, the special buffer for accumulating the coding data of image data temporarily can be made unnecessary. Here, ************* which is said video coding device and sets a threshold further to every [of the picture by which image data is coded] type (I picture, P picture, or B picture) is included.
[0085]since encoding methods differed for every I picture, P picture, and B picture and the orders of the code amount also differed by this, it responded to the picture type -- a threshold can be set up appropriately. When a picture type is B picture, here said skipping means, All the macro blocks of the remainder except the beginning of a slice layer and the last use the all skip B picture which is a B picture which comprises a skip DOMAKU lob lock as a proxy code, When a picture type is I or P picture, all the macro blocks of the remainder except the beginning of a slice layer and the last use the all skip P picture which is a P picture which comprises a skip DOMAKU lob lock as a proxy code.
[0086]Thereby, the proxy code which defined that the same image data as the image data decrypted in the past should have been displayed can be created using the skip DOMAKU lob lock of MPEG. Here, the threshold of said threshold setting means is characterized by being a prediction code amount. Thereby, since the prediction code amount of the picture for every picture type of I, P, and B is set as a threshold, the underflow of a receive buffer can be prevented with high precision.
[0087]Here, said threshold setting means computes the variance of a pixel value for every image data, and a bigger threshold is set up, so that the variance concerned is large. Since the code amount of the image data generally becomes large by this so that the variance of the pixel of image data is large, the underflow of a receive buffer can be prevented more to high degree of accuracy by setting up a big threshold by the big image data of a variance.
[0088]Said threshold setting means makes VAR_j the minimum of the variances of the pixel value of the image data in each 8 blocks (4 blocks in frame DCT mode, and 4 blocks in field DCT mode) block included in the macro block j here, When the activity of the macro block j is made into act_j, it is considered as $act_j=1+VAR_j$ and the activity ACT of image data is considered as total of the activity of all the macro blocks, A bigger threshold is set up as a picture with the big activity ACT of image data.
[0089]Since the code amount of the image data generally becomes large by this so that the activity of image data is large, the underflow of a receive buffer can be prevented more to high degree of accuracy by setting up a big threshold by image data with a big activity. Here, said threshold setting means sets each prediction code amount as a threshold about I or P picture, and sets a bigger value than the prediction code amount of B picture as a threshold about B picture.
[0090]the threshold of B picture is set up by this more highly than a prediction code amount -- B picture, since it becomes easy to skip, The same picture can be prevented from the skip by I or P picture referred to at other pictures being able to take place, being able to ****, and as a result being

displayed continuously repeatedly. Here said threshold setting means in the case of M (I or appearance cycle of P picture)>=2, For the prediction code amount of Ei and P picture, when the amount of transmitted bits per decoding time interval of Eb and one picture is set to R for the prediction code amount of Ep and B picture, the prediction code amount of I picture, If threshold Ti=Ei of I picture, threshold Tp=Ep of P picture, and encoding order make Tb(i) the threshold of B picture in front of I picture, If encoding order sets the threshold of B picture in front of P picture to Tb (p) at the time of Tb (i)=Eb <(Ei-R) 0 the time of Tb(i)=Eb+(Ei-R) (Ei-R)>=0, It is considered as the time of Tb(p) =Eb <(Ep-R) 0 the time of Tb(p) =Eb+(Ep-R) (Ep-R)>=0.
[0091]Thereby, based on the prediction code amount of I or P picture, the threshold of B picture in front of I or P picture can be set up so that a skip may not take place by I or P picture. Here said threshold setting means in the case of M (I or appearance cycle of P picture)>=3, For the prediction code amount of Ei and P picture, when the amount of transmitted bits per decoding time interval of Eb and one picture is set to R for the prediction code amount of Ep and B picture, the prediction code amount of I picture, If threshold Ti=Ei of I picture, threshold Tp=Ep of P picture, and encoding order make Tb2(i) the threshold of B picture (B-2(i)) in front of I picture, the time of Tb2(i)=Eb+(Ei-R) (Ei-R) >=0 -- the time of Tb2(i)=Eb <(Ei-R) 0 -- encoding order -- B-2(i), if the threshold of the last B picture (B1(i)) is made into Tb1(i), At the time of Tb1(i)=Eb+(Tb2(i)-R) (Tb2(i)-R) >=0. If encoding order sets the threshold of B picture (B-2 (p)) in front of P picture to Tb2 (p) at the time of Tb1(i)=Eb <(Tb2(i)-R) 0, If encoding order sets the threshold of B picture (B1 (p)) in front of B-2 (p) to Tb1 (p) at the time of Tb2 (p) =Eb <(Ep-R) 0 the time of Tb2(p) =Eb+(Ep-R) (Ep-R)>=0, It is considered as the time of Tb1(p) =Eb <(Tb2(p)-R) 0 at the time of Tb1(p) =Eb+(Tb2(p)-R) (Tb2(p)-R) >=0.
[0092]Thereby, based on the prediction code amount of I or P picture, the threshold of B picture in front of I or P picture and B picture in front of the B picture concerned can be set up so that a skip may not take place by I or P picture. Here, as for said threshold setting means, at the time of M (I or appearance cycle of P picture)>=3, encoding order is higher than the threshold of B picture (B1) in front of the B picture (B-2) concerned, and encoding order sets up the threshold of B picture (B-2) in front of I picture.
[0093]By this the skip of B picture for avoiding the skip by I or P picture, A time [the uncertainty of whether it can be made easy to happen just before I or P picture, and a skip is required of I or P picture is high], That is, when predicting the accumulated dose of the receive buffer of the decryption time of P picture based on many prediction items, the skip by unnecessary B picture is avoidable.
[0094]Here said threshold setting means in the case of M (I or appearance cycle of P picture)>=3, For the prediction code amount of Ei and P picture, when the amount R of transmitted bits per decoding time interval of Eb and one picture and the code amount of an all skip B picture are set to Dbskip for the prediction code amount of Ep and B picture, the prediction code amount of I picture, If threshold Ti=Ei of I picture, threshold Tp=Ep of P picture, and encoding order consider it as threshold Tb2(i) of B picture (B-2(i)) in front of I picture, the time of Tb2(i)=Eb+(Ei-R) (Ei-R)>=0 -- the time of Tb2(i)=Eb < (Ei-R) 0 -- encoding order -- B-2(i) -- if the threshold of the last B picture (B1(i)) is made into Tb1(i) -- Tb1(i)=Dbskip+ (Tb2(i)-R)
If encoding order sets the threshold of B picture (B-2 (p)) in front of P picture to Tb2 (p) at the time of Tb1(i)=EbDbskip+(Tb2(i)-R) <Eb at the time of Dbskip+(Tb2(i)-R) >=Eb, It is Tb2 (p) the time of Tb2(p) =Eb+(Ep-R) (Ep-R)>=0. When encoding order sets the threshold of B picture (B1 (p)) in front of B-2 (p) to Tb1 (p) at the time of =Eb <(Ep-R) 0, it is Tb1(p) =Dbskip+ (Tb2(p)-R).
It is considered as the time of Tb1(p) =EbDbskip+(Tb2(p)-R) <Eb at the time of Dbskip+(Tb2(p)-R) >=Eb.

[0095]Since it restricts to the time when it skips by B-2 picture and B1 picture is also skipped by this in order to avoid the skip by I or P picture, When the uncertainty of whether a skip is required of I or P picture is high (i.e., when predicting the accumulated dose of the receive buffer of the decryption time of P picture based on many prediction items), the skip by B1 unnecessary picture is avoidable.
[0096]In [this invention is a video coding device which codes the image data of one frame or the 1 field while predicting the accumulated dose of the receive buffer in a decoding device, and] after coding of image data, According to a picture type, threshold Ti when image data is coded by I picture in the case of M (I or appearance cycle of P picture)>=2, Threshold Ti when the code amount of the I picture concerned was set to Di, it is set as Ti=Di and image data is coded by P picture, If the code amount of the P picture concerned is set to Dp, will set it as Tp=Dp and encoding order threshold Tb(i) when image data is coded by B picture in front of I picture, If the code amount of the B picture is set to Db, the prediction code amount of I picture is set to Ei and the amount of transmitted bits per decoding

time interval of one picture is set to R, The time of Tb(i)=Db+(Ei-R) (Ei-R)>=0 At the time of Tb(i)=Db < (Ei-R) 0. It is alike and set up, and threshold Tb (p) when image data is coded by B picture in front of P picture sets the code amount of the B picture to Db, and encoding order sets the prediction code amount of P picture to Ep, When the amount of transmitted bits per decoding time interval of one picture is set to R, at the time of Tb(p) =Db+(Ep-R) (Ep-R)>=0. In after the threshold setting means set up without the time of Tb(p) =Db <(Ep-R) 0, and the numerals of image data, When it is probably accumulated in the receive buffer in the decryption time of the coding data of the image data, a prediction accumulated dose, A comparison means to compare said set-up threshold, and when a prediction accumulated dose is less than a threshold, It had the skipping means using the proxy code which defined that the image data same instead of the coding data of said image data taken out from a receive buffer at said decryption time as the image data decrypted in the past should have been displayed.

[0097]Since a threshold is always set up by this not more than the prediction code amount of a picture but more than a actual code amount while a skip makes it hard to happen by I or P picture, the underflow of a receive buffer can be prevented certainly. This invention is a video coding device which codes the image data of one frame by the frame structure, A comparison means to compare the accumulated dose of an output buffer, or the prediction accumulated dose of the receive buffer of a decoding device with a predetermined reference value when coding image data, When judged with said accumulated dose or the prediction accumulated dose having reached the predetermined reference value, Stop the coding by the frame structure of said image data, and instead of the coding data of the top field of said image data, and a bottom field, It had the skipping means using the proxy code which defined that the two same fields as the top field or bottom field which constitutes the image data decrypted in the past should have been displayed.

[0098]By this, when skipping coding of image data, How to assign a picture changes to field structure, and each field of the skipped image data, Since it can be referred to [a top field, a bottom field, or], even when it skips, the situation which a display order reverses can be prevented by maintaining the frame structure.

[0099]the top field where said skipping means constitutes here the image data decrypted in the past -- moreover -- and among bottom fields, A display order uses the proxy code which defined that the two same fields as the nearest field should have been displayed for each field of the image data which stopped the coding by said frame structure.

[0100]By this each field of the image data which skipped coding, Since a display order cannot become behind rather than the reference destination field of the bottom field of the image data which the reference destination field of the top field of the image data which skipped coding skipped since the nearest field of the display order was made into the reference destination field, The inversion of a display order is certainly avoidable.

[0101]When the type of a picture with which said image data which stopped the coding by the frame structure was due to be coded is B picture, here said skipping means, All the macro blocks of the remainder except the beginning of a slice layer and the last use as said proxy code two of the all skip B pictures which are B pictures which comprise a skip DOMAKU lob lock, When the type of a picture with which said image data which stopped the coding by the frame structure was due to be coded is I or P picture, All the macro blocks of the remainder except the beginning of a slice layer and the last use as said proxy code two of the all skip P pictures which are P pictures which comprise a skip DOMAKU lob lock.

[0102]Thereby, the proxy code which defined that the same image data as the image data decrypted in the past should have been displayed can be created using the skip DOMAKU lob lock of MPEG. By said all skip P picture used when the type of a picture with which said image data which stopped the coding by the frame structure was due to be coded is I or P picture, here said skipping means. A display order makes a reference field the bottom field of the image data of I used as the point, or P picture, In said all skip B picture which is used in the case of B picture (B1) by which the type of a picture with which said image data which stopped the coding by the frame structure was due to be coded is coded just behind I or P picture. A display order makes a reference field the bottom field of the image data of I used as the point, or P picture, In said all skip B picture which is used in the case of B picture (B-2) by which the type of a picture with which said image data which stopped the coding by the frame structure was due to be coded is coded just before I or P picture. A display order makes a reference field the top field of the image data of I which becomes the back, or P picture.

[0103]Since the all skip picture which specified the suitable reference field is chosen by this according

to a picture type, the inversion of a display order is simply and appropriately avoidable. When the type of a picture with which said image data which stopped the coding by the frame structure was due to be coded is I or P picture, here said skipping means, Coding of the image data coded by B picture after that is stopped, and a display order uses two of the all skip B pictures which made the previous bottom field the reference field instead of the coding data of the top field of the image data concerned, and a bottom field.

[0104]By this, when generated by skip in P or I picture, The field of the image data of B picture which refers to it and which is doing things can also prevent the inversion of a display order by making the field as the field made into the reference destination where the field of the skipped image data is the same into the reference destination field. This invention, predicting the accumulated dose of the receive buffer in a decoding device. It is a video coding device which codes the image data of one frame or the 1 field, The prediction accumulated dose predicted to probably be accumulated in the receive buffer in the decryption time of the coding data of the image data concerned before coding image data, A comparison means to compare the threshold for every picture type by which image data is coded, When the type of a picture with which it is a case where a prediction accumulated dose is less than a threshold, and said image data is coded is B picture, Coding of said image data was stopped and it had the control means using the proxy code which defined that the image data same instead of the coding data of said image data taken out from a receive buffer at said decryption time as the image data decrypted in the past should have been displayed.

[0105]Since the prediction accumulated dose of a receive buffer restricts less than a threshold in the case of B picture and skips a picture by this, About I or P picture referred to at other pictures, the number of times as which the same picture is continuously displayed by performing the coding which controlled the code amount etc. can be lessened. This invention, predicting the accumulated dose of the receive buffer in a decoding device. It is a video coding device which codes the image data of one frame or the 1 field, The prediction accumulated dose predicted to probably be accumulated in the receive buffer in the decryption time of the coding data of the image data concerned before coding image data, A comparison means to compare the threshold for every picture type by which image data is coded, When the type of a picture with which it is a case where a prediction accumulated dose is less than a threshold, and said image data is coded is B or P picture, Coding of said image data was stopped and it had the control means using the proxy code which defined that the image data same instead of the coding data of said image data taken out from a receive buffer at said decryption time as the image data decrypted in the past should have been displayed.

[0106]Since the prediction accumulated dose of a receive buffer restricts less than a threshold in the case of B or P picture and skips a picture by this, about I picture referred to at other pictures, the frequency where the same picture is continuously displayed by performing the coding which controlled the code amount etc. can be reduced. This invention, predicting the accumulated dose of the receive buffer in a decoding device. It is the video coding method which codes the image data of one frame or the 1 field, The prediction accumulated dose predicted to probably be accumulated in the receive buffer in the decryption time of the coding data of the image data concerned before coding image data, The step which compares a predetermined threshold, and when a prediction accumulated dose is less than a threshold, As data which stops coding of said image data and is taken out from a receive buffer at said decryption time, The step using the proxy code which defined that the image data same instead of the coding data of said image data as the image data decrypted in the past should have been displayed is included.

[0107]Since it judges by this whether coding is stopped or not before coding image data, in order to judge whether the prediction accumulated dose of a receive buffer becomes in less than a threshold, the special buffer for accumulating the coding data of image data temporarily can be made unnecessary. This invention is the video coding method which codes the image data of one frame by the frame structure, The step which compares the accumulated dose of an output buffer, or the prediction accumulated dose of the receive buffer of a decoding device with a predetermined reference value when coding image data, When judged with said accumulated dose or the prediction accumulated dose having reached the predetermined reference value, Stop the coding by the frame structure of said image data, and instead of the coding data of the top field of said image data, and a bottom field, The step using the proxy code which defined that the two same fields as the top field or bottom field which constitutes the image data decrypted in the past should have been displayed is included.

[0108]By this, when skipping coding of image data, How to assign a picture changes to field structure, and each field of the skipped image data, Since it can be referred to [a top field, a bottom field, or],

even when it skips, the situation which a display order reverses can be prevented by maintaining the frame structure.

[0109]The video coding program of this invention, predicting the accumulated dose of the receive buffer in a decoding device. In order to code the image data of one frame or the 1 field a computer, The prediction accumulated dose predicted to probably be accumulated in the receive buffer in the decryption time of the coding data of the image data concerned before coding image data, A comparison means to compare a predetermined threshold, and when a prediction accumulated dose is less than a threshold, Coding of said image data is stopped and it is made to function as a skipping means using the proxy code which defined that the image data same instead of the coding data of said image data as data taken out from a receive buffer at said decryption time as the image data decrypted in the past should have been displayed.

[0110]Since it judges by this whether coding is stopped or not before coding image data, in order to judge whether the prediction accumulated dose of a receive buffer becomes in less than a threshold, the special buffer for accumulating the coding data of image data temporarily can be made unnecessary. In order that the video coding program of this invention may code the image data of one frame by the frame structure, a computer, A comparison means to compare the accumulated dose of an output buffer, or the prediction accumulated dose of the receive buffer of a decoding device with a predetermined reference value when coding image data, When judged with said accumulated dose or the prediction accumulated dose having reached the predetermined reference value, Stop the coding by the frame structure of said image data, and instead of the coding data of the top field of said image data, and a bottom field, It is made to function as a skipping means using the proxy code which defined that the two same fields as the top field or bottom field which constitutes the image data decrypted in the past should have been displayed.

[0111]By this, when skipping coding of image data, How to assign a picture changes to field structure, and each field of the skipped image data, Since it can be referred to [a top field, a bottom field, or], even when it skips, the situation which a display order reverses can be prevented by maintaining the frame structure.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, the following problems are among the methods indicated to the above-mentioned Patent Gazette. The 1st problem is that the buffer memory 20 which stores temporarily the generated picture as shown in drawing 22 is needed, in order to judge whether the generated amount of pictures is over a transmission rate. Namely, although what was necessary was just to have had the buffer of the small capacity for accumulating the coding data of a macro block unit when it was judged as mentioned above whether it skips for every macro block, In this method, since it judges whether it skips by the whole picture, the mass buffer capacity for storing the code amount of all the macro blocks in a picture is needed.
[0015]When one frame is being assigned to one picture (frame structure), a picture is skipped and the 2nd problem is displayed with an interlace scanning system, it is that a display order may be reversed. Drawing 23 (a) shows the display screen at the time of usual [which does not skip a picture]. 1t and 1b express the top field of the 1st frame, and a bottom field, respectively. In the frame structure, coding processing is made by making into a unit one frame which combined the top field and the bottom field. In this case, in a decoding device, decoding processing is made by making 1 / 1 per 30 seconds into a unit. Since it displays with an interlace system, each field in a frame is displayed every [1/] 60 seconds. That is, it is displayed in order of 1t, 1b, 2t, 2b, and 3t, 3b, 4t and 4b.
[0016]Drawing 23 (b) shows the display screen at the time of being generated by the skip of a picture. In B (3), when generated by skip, the same picture as I (1) which B (3) is referring to is expressed as the frame 2 coded by B (3). Therefore, the top field of the frame 2 becomes the same as 1 t which is a top field of the frame 1, and the bottom field of the frame 2 becomes the same as 1b which is a bottom field of the frame 1. And in order to display with an interlace system, it is displayed every [1/] 60 seconds in order of 1t, 1b, 1t, 1b, 3t, 3b, 4t, and 4b. Thereby, 1 t will be displayed after 1b and a display order will be reversed.
[0017]Then, the purpose of this invention is as follows.
Make unnecessary the special buffer for judging whether the whole picture is skipped.
Even when you skip the whole picture, provide the video coding device which a display order does not reverse.

[Translation done.]

MEANS

[Means for Solving the Problem]To achieve the above objects, this invention is characterized by that a video coding device which codes image data of one frame or the 1 field comprises the following, predicting an accumulated dose of a receive buffer in a decoding device.
A prediction accumulated dose predicted to probably be accumulated in a receive buffer in decryption time of coding data of the image data concerned before coding image data.
A comparison means to compare a predetermined threshold.
When a prediction accumulated dose is less than a threshold, as data which stops coding of said image data and is taken out from a receive buffer at said decryption time, A skipping means using a proxy code which defined that the image data same instead of coding data of said image data as image data decrypted in the past should have been displayed.

[0019]This invention is characterized by that a video coding device which codes image data of one frame by the frame structure comprises:
A comparison means to compare an accumulated dose of an output buffer, or a prediction accumulated dose of a receive buffer of a decoding device with a predetermined reference value when coding image data.
When judged with said accumulated dose or a prediction accumulated dose having reached a predetermined reference value, Stop coding by the frame structure of said image data, and instead of coding data of a top field of said image data, and a bottom field, A skipping means using a proxy code which defined that the two same fields as a top field or a bottom field which constitutes image data decrypted in the past should have been displayed.

[0020]
[Embodiment of the Invention]Hereafter, an embodiment of the invention is described using a drawing.
Before the <1st embodiment> book embodiment generates a picture, it is related with the video coding device which judges whether a picture is skipped by whether the prediction code amount based on the experience value for every picture type is over the prediction accumulated dose of a receive buffer.
(Composition of a video coding device) Drawing 1 shows the composition of the video coding device 100 concerning this embodiment. The video coding device 100 The screen rearranging means 110 and the DCT means 113, The quantization means 114, the rate control means 115, and the variable-length-coding means 116, The buffer 117, the inverse quantization means 119, and the reverse DCT means 120, It comprises the video memory 122, the motion-compensation-prediction means 123, the adding machines 111 and 112, the change machine 118, the receive buffer accumulated dose prediction means 124, the comparison judging means 125, the SKIP picture storing memory 126, and the threshold setting means 127.
[0021]The screen rearranging means 110 is rearranged into an order which codes a screen according to a picture type. Drawing 2 (a) shows an order of a video image from the first, therefore an order displayed with a decoding device. Drawing 2 (b) shows encoding order, therefore an order of being inputted into a decoding device. In order to code using I of order, or the picture of P picture in time, B picture is coded after coding P picture of the future.
[0022]The DCT means 113 performs a discrete cosine transform (DCT) operation by a macro block unit, and outputs a DCT coefficient. Here about I (Intra coded) picture. In intra coding mode, perform DCT operation and about P (Predictive coded) picture and B (Bidirectionally predictive coded) picture. Intra coding mode or motion-compensation-prediction mode is chosen by a macro block unit, and DCT operation is performed. In the case of intra coding mode, DCT operation of the inputted original image is

carried out as it is. In the case of motion-compensation-prediction mode, DCT operation of the difference of an original image and the estimated image obtained by the motion-compensation-prediction means 123 is carried out.

[0023]The quantization means 114 makes a quantizing scale change for every macro block, and quantizes a DCT coefficient. The variable-length-coding means 116 carries out variable length coding of the quantized DCT coefficient with a motion vector and coding prediction mode information, and generates the coding data of image data.

[0024]The buffer 117 stores the coding data or the all skip picture of image data by which variable length coding was carried out. About the decryption picture of I or P picture, since it is necessary to use the inverse quantization means 119 and the reverse DCT means 120 as an image comparison of motion compensation prediction, they restore the decryption picture acquired from the quantized DCT coefficient by performing inverse quantization and reverse DCT, and output it to the video memory 122.

[0025]The video memory 122 stores the decryption picture of I or P picture as an image comparison. The motion-compensation-prediction means 123 outputs an estimated image using the image comparison lost-motion vector stored in the video memory 122 for coding of P or B picture. The rate control means 15 directs change of a quantizing scale to the quantization means 114 according to the prediction accumulated dose of a receive buffer. That is, it is directed to the quantization means 114 that the rate control means 115 will enlarge a quantizing scale if below a constant rate becomes so that a quantizing scale may be made small, if a fixed quantity of prediction accumulated doses of a receive buffer become above.

[0026]The SKIP picture storing memory 126 stores the all skip picture the object for P pictures, and for B pictures. Here, an all skip picture means the picture that all the macro blocks of the remainder except the beginning of the slice layer in 1 picture and the last comprise a skip DOMAKU lob lock. B picture to which all the macro blocks of the remainder except the beginning of a slice layer and the last consist of a skip DOMAKU lob lock instead of B picture and P picture, respectively, P picture (these are called an all skip B picture and an all skip P picture, respectively.) is sent out. I picture is that (a macro block is not made to a skip DOMAKU lob lock.) which cannot be skipped, and an all skip P picture is sent out instead of I picture. If these all skip pictures are sent out instead of the coding data of image data and the coding data of image data says, they will be proxy codes.

[0027]Whenever the receive buffer accumulated dose prediction means 124 outputs one picture, it computes the prediction accumulated dose of the receive buffer before decoding in the decryption time of the following picture. Drawing 3 (a) shows the prediction accumulated dose of the receive buffer at the time of usual [which does not skip a picture]. If the prediction accumulated dose of the receive buffer before decoding in the time of DTSn is set to VBV (n), the bit yield of B picture decrypted at the time of DTSn is set to Db and the amount of transmitted bits for every DTS interval is set to R, VBV (n+1) =VBV(n)-Db+R will be computed.

[0028]Drawing 3 (b) shows the prediction accumulated dose of a receive buffer when a picture is skipped. The prediction accumulated dose of the receive buffer before decoding in the time of DTSn is set to VBV (n), The bit yield of the all skip B picture decrypted at the time of DTSn is set to Dbskip, and if bit quantity transmitted from the coding equipment for every DTS interval is set to R, VBV(n+1) =VBV(n)-Dbskip+R will be computed.

[0029]The threshold setting means 127 sets a threshold (Ti, Tp, Tb1, Tb2), respectively to every picture type (I, P, B1, B-2 picture). Drawing 4 shows the example of setting out of a threshold. Like a following formula, the code amount (prediction code amount) Ei and Ep which are experientially known for every picture type, and Eb are set as the thresholds Ti and Tp, Tb1, and Tb2, respectively.
According to a Ti=EiTp=EpTb1=EbTb2=Eb book embodiment, Ei=400kbit known experientially, Ep=200kbit, and Eb=160kbit shall be used as optimal value in case the resolution of image data is 720 pixels x 480 pixels. Since they have proportionality mostly, the resolution and the prediction code amount of image data should just compute a prediction code amount in proportion to resolution, even when resolution differs from the above.

[0030]It is judged whether the comparison judging means 125 skips coding processing of a picture for the prediction accumulated dose VBV of a receive buffer, and the size of a threshold [before the image data is coded] for every image data. Namely, it judges with the comparison judging means 125 skipping VBV<Ti, when coding the picture as an I picture, It judges with skipping VBV<Tp, in coding the picture as a P picture, In coding the picture as B1 picture, it judges with skipping VBV<Tb1, and in coding the picture as a B-2 picture, it judges with skipping VBV<Tb2.

[0031]Drawing 5 shows an example in case a picture is skipped. In drawing 5 (a), I picture is skipped in

DTSn by VBV<Ti. In drawing 5 (b), B1 picture is skipped in DTSn+1 by VBV<Tb1.

[0032]In drawing 5 (c), B-2 picture is skipped in DTSn+2 by VBV<Tb2. In drawing 5 (d), P picture is skipped in DTSn+3 by VBV<Tp. When it judges with the comparison judging means 125 skipping a picture, while stopping coding processing to the DCT means 113, the all skip picture according to a picture type is made to output from the SKIP picture storing memory 126.

[0033]Drawing 6 (a) shows the example of the screen usually displayed with a decoding device. The decryption picture of I (1), B (3), B (4), and P (2) is displayed by the 1st, the 2nd, the 3rd, and the 4th frame, respectively. () An inner number shows an order to code. Drawing 6 (b) shows the example of the screen displayed with a decoding device, when a picture is skipped. When B (3) picture of the 2nd frame is skipped, although B (3) is using the decryption picture of I (1) and P (2) as the image comparison, by the 2nd frame, the decryption picture of I (1) with a nearer display order is displayed.

(Operation) Next, the operation relevant to the skip processing of the video coding device concerning this embodiment is explained.

[0034]Drawing 7 is a flowchart in which the operation procedures of a video coding device are shown. First, the threshold setting means 127 sets up the thresholds Ti and Tp for a skip judging, Tb1, and Tb2 for every picture type (Step S501). Next, when coding an original image as an I picture, the comparison judging means 125 carries out the comparison test of the size of the prediction accumulated dose VBV of a receive buffer, and threshold Ti. In VBV>=Ti, coding processing is performed for an original image by the DCT means 113, the quantization means 114, and the variable-length-coding means 116 as an I picture (Step S502, S503, S504).

[0035]And the receive buffer accumulated dose prediction means 124 computes the prediction accumulated dose VBV of the receive buffer before the decryption in a following DTS time with the bit yield of I picture and the amount R of transmitted bits for every DTS time interval which were generated (Step S505). And when there is the following image data, processing is continued, and processing will be ended if there is no following image data (Step S506).

[0036]On the other hand, in Step S503, when the comparison judging means 125 judges with VBV<Ti, the comparison judging means 125 compares the size of VBV and Tp further. In VBV>=Tp, when coding processing is made as a P picture and an original image is VBV<Tp, an all skip P picture is outputted from the SKIP picture storing memory 126. And the receive buffer accumulated dose prediction means 124 with the bit yield of an all skip P picture, and the amount R of transmitted bits for every DTS time interval. The prediction accumulated dose VBV of the receive buffer before the decryption in a following DTS time is computed (Step S508, S509, S510, S505).

[0037]When coding an original image as a P picture, the comparison judging means 125 carries out the comparison test of the size of the prediction accumulated dose VBV of a receive buffer, and the threshold Tp. In VBV>=Tp, as usual, when coding processing is made as a P picture and an original image is VBV<Tp, an all skip P picture is outputted from the SKIP picture storing memory 126. With and the bit yield of P picture or the bit yield of an all skip P picture which the receive buffer accumulated dose prediction means 124 generated, and the amount R of transmitted bits for every DTS time interval. The prediction accumulated dose VBV of the receive buffer before the decryption in a following DTS time is computed (Step S507, S508, S509, S510, S505).

[0038]When coding an original image as B1 picture, the comparison judging means 125 carries out the comparison test of the size of the prediction accumulated dose VBV of a receive buffer, and threshold Tb1. In the case of VBV>=Tb1, as usual, when coding processing is made as a B picture and an original image is VBV<Tb1, an all skip B picture is outputted from the SKIP picture storing memory 126. With and the bit yield of B picture or the bit yield of an all skip B picture which the receive buffer accumulated dose prediction means 124 generated, and the amount R of transmitted bits for every DTS time interval. The prediction accumulated dose VBV of the receive buffer before the decryption in a following DTS time is computed (Step S511, S512, S513, S514, S505).

[0039]When coding an original image as a B-2 picture, the comparison judging means 125 carries out the comparison test of the size of the prediction accumulated dose VBV of a receive buffer, and threshold Tb2. In the case of VBV>=Tb2, as usual, when coding processing is made as a B picture and an original image is VBV<Tb2, an all skip B picture is outputted from the SKIP picture storing memory 126. With and the bit yield of B picture or the bit yield of an all skip B picture which the receive buffer accumulated dose prediction means 124 generated, and the amount R of transmitted bits for every DTS time interval. The prediction accumulated dose VBV of the receive buffer before the decryption in a following DTS time is computed (Step S511, S515, S513, S514, S505).

(Conclusion) as mentioned above, in the video coding device concerning this embodiment. It is not

judged whether once it generates a picture, a picture is skipped by whether the bit yield is over the prediction accumulated dose of a receive buffer, Since it judges whether a picture is skipped by whether the prediction code amount based on the experience value for every picture type is over the prediction accumulated dose of a receive buffer before generating a picture, The special buffer stored temporarily because of the judgment of whether to skip the generated picture can be made unnecessary.
[0040]As mentioned above, as for this invention, although a 1st embodiment was described, it is needless to say that it is not limited to the above-mentioned embodiment. That is, of course, the following modification is also included in this invention.
(Modification 1) Although the fixed value was used as a threshold, it may be made to decide a threshold in this embodiment according to the complexity for every original image.
[0041]Let P_k (k= 1-64) be a pixel value of the original image within an 8x8-pixel block. If it is the average value E within a block (P_k), it will become $E(P_k)$ =1/64xsigmaP_k. If a variance is set to V (P_k), it will become $V(P_k)$ =1/64xsigma(P_k-E (P_k)) ^{2}.
[0042]It will be set to VAR_j=MIN [V (P_k)] if the minimum of V (P_k) of 8 blocks (4 blocks in frame DCT mode and 4 blocks in field DCT mode) contained in the macro block j is made into VAR_j. It will become act_j=1+VAR_j if the activity of the macro block j is made into act_j.
[0043]It will become ACT=sigma act_j if the activity ACT of an original image is total of the activity of all the macro blocks. Since the complexity within the frame of an original image is high when an activity is a thing reflecting the variance of the pixel value of an original image and its activity is large, it is thought that there are many bit yields of a picture. Therefore, it is possible that what is necessary is just to set up a threshold highly, so that an activity is large.
[0044]It may be made to set up a threshold based on variance. For example, it is considered as VAR=sigma VAR_j, and if it is high in a threshold when VAR is large, and VAR is small, it may be made to set up a threshold low. Not the distribution for every block but distribution of the pixel of the whole picture may be used as variance. That is, if the pixel number of the whole picture is set to N and P_l (l=1-N) is made into the pixel value of an original image, the average value E of the pixel of the whole picture will serve as E=1/Nxsigma P_l, and the variance V of the whole picture will serve as V=1 / Nxsigma (P_l-E (P_l)) ^{2}. And if it is high in a threshold when V is large, and V is small, it may be made to set up a threshold low.
(Modification 2) According to this embodiment, when the prediction code amount for every picture type is over the prediction accumulated dose of a receive buffer, a picture shall be skipped irrespective of picture types. However, since the decryption picture of I picture or P picture is used as an image comparison of other pictures, the skip by I picture or P picture affects other pictures so that it may mention later. Therefore, it is good also as what performs either of whether whether a picture's being skipped and the coding which controlled a code amount which enlarges a quantizing scale, uses only the DC component after DCT, or codes pseudo image data are performed according to a picture type.
[0045]For example, when the prediction code amount is over the prediction accumulated dose of a receive buffer, only in the case of B picture, a picture is skipped, and, in the case of I or P picture, it is good also as what performs the coding which controlled the code amount. Or only in the case of B or P picture, a picture is skipped, and, in the case of I picture, it is good also as what performs the coding which controlled the code amount.
(Modification 3) Although underflow can be almost prevented in this embodiment, In order to prevent underflow thoroughly, when a prediction code amount is larger than the prediction accumulated dose of a receive buffer, As mentioned above, when carrying out underflow of the code amount of the macro block, and the accumulated dose of a receive buffer by a macro block unit as compared with the coding back, it may be made to consider the macro block as a skip DOMAKU lob lock.
The <2nd embodiment> book embodiment is related with the video coding device which the skip made it easy to happen by B picture rather than P or I picture.
(Elements of the Invention) Although the composition of the video coding device concerning this embodiment is common to the video coding device applied in general to a 1st embodiment, the methods of setting out of the threshold by the threshold setting means 127 differ. Hereafter, the setting method of the threshold by the threshold setting means 127 is explained.
[0046]The threshold setting means 127 sets a threshold (Ti, Tp, Tb1, Tb2), respectively to every picture

type (I, P, B1, B-2 picture). Drawing 8 shows the example of setting out of a threshold. Like a following formula, Ti and Tp are set as the prediction code amount Ei and Ep like a 1st embodiment.
When it skips by the Ti=EiTp=EpI picture or P picture, B picture which is referring to the skipped picture also becomes the same screen as the skipped picture. In this case, for example, at the time of M(I or appearance cycle of P picture) = 3, four frames becomes the same screen continuously. Therefore, the threshold of B picture is set up more greatly than a 1st embodiment so that a skip may take place by B picture in front of P picture as much as possible.
[0047]Drawing 9 is a figure explaining the threshold of B picture in front of P picture. If VBV (n+1) in the time of DTSn+1, at the time of DTSn+2, it will become VBV(n+2) =VBV(n+1)-Eb+R. It can be predicted that VBV(n+2) >=Tp does not happen at the time of DTSn+2 in the skip of P picture. If formula modification is carried out, it is necessary to become VBV(n+2) =VBV(n+1)-Eb+R>=Tp=Ep, and to fill the formula of VBV(n+1) >=Eb+ (Ep-R).
[0048]Since it is required like Embodiment 1 to be VBV(n+1) >=Eb, it is necessary to fill the formula of VBV(n+1) >=MAX (Eb, Eb+ (Ep-R)) after all. Therefore, it is referred to as threshold Tb2=MAX (Eb, Eb+ (Ep-R)), and when VBV is less than two Tb, B-2 picture will be skipped and the skip of a prediction top P picture can be prevented from happening at the time of DTSn+1.
[0049]It means that as for this new threshold Tb2 had added Tb2 (quantity equivalent to ** of drawing 9 (Ep-R).) of origin at the time of >=(Ep-R) 0 as shown in drawing 9. At the time of <(Ep-R) 0, threshold Tb2 is still Tb2 of origin. Similarly, at the time of DTSn if VBV (n), at the time of DTSn+2, it will become VBV(n+2) =VBV(n)-Eb+R-Eb+R=VBV(n)-Eb- (Eb-2R). It can be predicted that VBV(n+2) >=Tp does not happen at the time of DTSn+2 in the skip of P picture. If formula modification is carried out, it is necessary to become VBV(n+2) =VBV(n)-Eb-(Eb-2R) >=Tp=Ep, and to fill the formula of VBV(n) >=Eb+ (Ep+Eb-2R) =Eb+(Ep-R)+(Eb-R)=Eb+ (Tb2-R).
[0050]Since it is required like Embodiment 1 to be VBV(n) >=Eb, it is necessary to fill the formula of VBV(n) >=MAX (Eb, Eb+ (Tb2-R)) after all. Therefore, it is referred to as threshold Tb1=MAX (Eb, Eb+ (Tb2-R)), and when VBV is less than one Tb, B1 picture will be skipped and the skip of a prediction top P picture can be prevented from happening at the time of DTSn. It means that as for this new threshold Tb1 had added Tb1 (quantity equivalent to ** of drawing 9 (Ep-R)) of the basis at the time of >=(Tb2-R) 0 as shown in drawing 9 (quantity equivalent to ** of drawing 9 (Eb-R)). At the time of <(Tb2-R) 0, threshold Tb1 is still Tb1 of origin.
[0051]Ep only replaces Ei also about the threshold of B picture in front of I picture, and others are the same. In order to distinguish I picture and P picture, the threshold of B1 picture in front of P picture Tb2 (p), In the threshold of B-2 picture in front of P picture, if the threshold of B-2 picture in front of Tb2(i) and I picture is made into Tb1(i), the following formulas will be materialized [threshold / of B-2 picture in front of Tb1 (p) and I picture].
[0052]
Tb2(p) =MAX (Eb, Eb+ (Ep-R))
Tb1(p) =MAX (Eb, Eb+ (Tb2(p)-R))
Tb2(i)=MAX (Eb, Eb+ (Ei-R))
Tb1(i)=MAX (Eb, Eb+ (Tb2(i)-R))
Drawing 10 (a) shows transition of the prediction accumulated dose of the receive buffer in the threshold in a 1st embodiment. At the time of DTSn and DTSn+1, since VBV becomes at the time of DTSn+2 in less than the threshold Tp, without being generated by the skip of threshold Tb1, Tb2, as mentioned above B picture in the prediction accumulated dose VBV of a receive buffer, it is generated by the skip of P picture.
[0053]Drawing 10 (b) shows transition of the prediction accumulated dose of the receive buffer in the threshold in this embodiment. Since threshold Tb1 was highly set up as shown in the figure, it is generated by the skip of B1 picture when it is DTSn. By this, the prediction accumulated dose VBV of a receive buffer increases, and only the difference (Db1-Dskip) of the bit yield of B1 picture, and the amount of all skip B pictures at the time of DTSn+2. Since the prediction accumulated dose VBV of a receive buffer becomes beyond the threshold Tp, it is not generated by the skip of P picture.
[0054]Drawing 11 (a) shows the example of the screen usually displayed with a decoding device. The decryption picture of I (1), B (3), B (4), and P (2) is displayed by the 1st, the 2nd, the 3rd, and the 4th frame, respectively. () An inner number shows an order to code. Drawing 11 (b) shows the example of the screen displayed with a decoding device, when the skip of a picture is judged with the threshold of a 1st embodiment. In the threshold set up by a 1st embodiment, since the threshold is not set up that it is easy to skip by B picture before P picture, it is easy to generate a skip by P picture. In this case, since

P (2) is using the decryption picture of I (1) as the image comparison by having skipped P (2) picture, the decryption picture of I (1) is displayed in the 4th frame. Since B (3) and B (4) are referring to P (2), the 2nd and at least three decryption pictures of I (1) are displayed.
[0055]Drawing 11 (c) shows the example of the screen displayed with a decoding device, when the skip of a picture is generated in the threshold of this embodiment. In the threshold set up by this embodiment, since the threshold is set up that it is easy to skip by B picture before P picture, it is easy to generate a skip by B picture. In this case, although B (3) is using the decryption picture of I (1) and P (2) as the image comparison by having skipped B (3) picture of the 2nd frame, in the 2nd frame, the decryption picture of I (1) with a nearer display order is displayed. Since there is no picture which is referring to B (3) picture, the decryption picture of other pictures is displayed as usual.
[0056]Drawing 11 (d) shows the example of the screen displayed with a decoding device, when the skip of a picture is generated in the threshold of this embodiment. In this case, although B (4) is using the decryption picture of I (1) and P (2) as the image comparison by having skipped B (4) picture of the 3rd frame, in the 3rd frame, the decryption picture of P (2) with a nearer display order is displayed. Since there is no picture which is referring to B (4) picture, the decryption picture of other pictures is displayed as usual.
(Operation) Operation of the video coding device of this embodiment only differs in operation of a 1st embodiment, and the contents of processing of Step S501 in drawing 7, and others are common. Therefore, explanation of procedure is omitted.
(Conclusion) As mentioned above, since the threshold of B picture is set up highly according to the video coding device concerning this embodiment fulfill the prediction conditions that a skip does not take place by P picture, In usual, even when a skip takes place by P picture, the skip of P picture can be avoided by skipping previously by the last B picture.
(Modification 1) The video coding device of this embodiment, Since it has the original effect which is not in a 1st embodiment of avoiding the skip by P picture, Even if it constitutes so that it may once accumulate in a buffer memory after generating a picture as JP,2871316,B indicates the video coding device of this embodiment, there is a different effect from a Patent Gazette.
[0057]That is, it is good also as what codes image data, generates a picture, once accumulates the picture in a buffer memory, sets up a threshold which avoids the skip by P picture as follows based on the bit yield of the picture, and judges whether it skips or not. Threshold Ti when image data is coded by I picture will be set as a following formula, if the bit yield of the I picture is set to Di.
The threshold Tp when Ti=Di and image data are coded by P picture will be set as a following formula, if the bit yield of the P picture is set to Dp.
[0058]Threshold Tb(i) when Tp=Dp and image data are coded by B picture in front of I picture, If the bit yield of the B picture is set to Db, the prediction code amount of I picture is set to Ei and the amount of transmitted bits per decoding time interval of one picture is set to R, in order to avoid the skip by I picture, it is set as a following formula.
[0059]
Tb(i)=MAX (Db, Db+ (Ei-R))
Threshold Tb (p) when image data is coded by B picture in front of P picture, If the bit yield of the B picture is set to Db, the prediction code amount of P picture is set to Ep and the amount of transmitted bits per decoding time interval of one picture is set to R, in order to avoid the skip by P picture, it is set as a following formula.
[0060]
Tb(p) =MAX (Db, Db+ (Ep-R))
(Modification 2) Drawing 12 shows the example of setting out of other thresholds. Like a following formula in Ti, Tp, Tb2 (p), and Tb2(i), the same value as a 2nd embodiment is set up.
[0061]Ti=EiTp=EpTb2(p) =MAX (Eb, Eb+ (Ep-R))
Tb2(i)=MAX (Eb, Eb+ (Ei-R))
According to a 2nd embodiment, since the threshold of B1 picture is set up highly as mentioned above, it is easy to generate a skip. However, when the actual bit yield of B1, B-2, and P picture is smaller than the amount of prediction, even if it does not skip by B1 picture, the skip of P picture may not take place. Therefore, it is desirable at the point of avoiding the skip it is more nearly unnecessary to confirm whether it waiting and skipping as much as possible till B-2 picture in front of P picture.
[0062]On the other hand, even if it judges with waiting and skipping till B-2 picture, when there are quite few prediction accumulated doses of a receive buffer, the skip of P picture may be unable to be avoided only by skipping B-2 picture. Therefore, even if it skips B1 picture by B-2 picture, it decides to restrict

moreover, when a skip takes place by P picture, and to skip, and sets up the threshold of B1 picture for it.

[0063]Drawing 13 is a figure explaining the threshold of B picture in front of P picture. At the time of DTSn if VBV (n), at the time of DTSn+2, it will become VBV(n+2) =VBV(n)-Eb+R-Dbskip+R=VBV(n)-Eb-(Dbskip-2R). Here, Dbskip is a bit yield of an all skip B picture. If it is VBV(n+2) >=Tp, the skip of P picture will not take place in the time of DTSn+2. If formula modification is carried out, it is necessary to become VBV(n+2) =VBV(n)-Eb-(Dbskip-2R) >=Tp=Ep, and to fill the formula of VBV(n) >=Eb+(Ep+Dbskip-2R) =Eb+(Ep-R)+(Dbskip-R)=Dbskip+ (Tb2-R).

[0064]Since it is required like Embodiment 1 to be VBV(n) >=Eb, it is necessary to fill the formula of VBV(n) >=MAX (Eb, Dbskip+ (Tb2-R)) after all. Therefore, it is referred to as threshold Tb1=MAX (Eb, Dbskip+ (Tb2-R)), and when VBV is less than one Tb, B1 picture will be skipped and the skip of a prediction top P picture can be prevented from happening at the time of DTSn.

[0065]this shows drawing 13 at the time of Dbskip+(Tb2-R) >=Eb -- as -- new threshold Tb1 -- Tb1 (quantity equivalent to ** of drawing 13 (Ep-R)) of a basis -- adding (quantity equivalent to ** of drawing 13 (R-Dbskip)) -- it means reducing At the time of Dbskip+(Tb2-R) <Eb, threshold Tb1 is still Tb1 of origin.

[0066]Ep only replaces Ei also about the threshold of B picture in front of I picture, and others are the same. Therefore, the following formulas are materialized.

Tb1(p) =MAX (Eb, Dbskip+ (Tb2(p)-R))

Tb1(i)=MAX (Eb, Dbskip+ (Tb2(i)-R))

When one frame is being assigned to one picture (frame structure) and coding of image data is skipped, the <3rd embodiment> book embodiment is related with the video coding device which a display order does not reverse, even if it displays with an interlace scanning system.

(Elements of the Invention) The composition of the video coding device concerning this embodiment is common in general. Hereafter, a different point is explained.

[0067]A screen rearranging means rearranges image data per frame. The DCT means 113 is coding the image data of the frame unit. When the prediction accumulated dose of a receive buffer is less than a threshold, the comparison judging means 125 makes the DCT means 113 stop coding processing of the image data of the following frame, and makes an all skip picture output from the SKIP picture storing memory 126 like a 1st embodiment.

[0068]The all skip picture P picture of a field structural steel worker and all skip B picture which make a reference destination a forward's (a display order is the point) bottom field or top field [being backward (a display order. after)] are stored in a SKIP picture storing memory. In these all skip pictures, what makes a reference destination the field where a display order is the nearest is chosen as the field of the skipped image data by the comparison judging means 125, and is sent out to it.

[0069]Drawing 14 shows the picture header of the picture layer of an all skip B picture, and picture encoding extension. As shown in ** of the figure, picture structure is specified as the top field. Drawing 15 shows the field referred to in the case of skipping the frame 2. Drawing 15 (a) shows the case of M(I or appearance cycle of P picture) = 1. Since the frame 2 is P picture, the field usable as a reference field is set to 1t and 1b. Among these, since both 2 t and 2b have a display order close to 1b, 1b becomes a reference field of 2 t and 2b.

[0070]Therefore, originally, when coding 1t and 1b, the all skip P picture which makes the forward's bottom field the reference destination is outputted. Drawing 15 (b) shows the case of M(I or appearance cycle of P picture) = 2. Since the frame 2 is B picture, the field usable as a reference field is set to 1t, 1b, 3t, and 3b. Since a display order is close to 1b, 2 t 1b becomes a reference field which is 2t. Since the display order of 2b is close to 3 t, 3 t becomes a reference field of 2b.

[0071]Therefore, originally, when coding 2 t, the all skip B picture which makes the forward's bottom field the reference destination is outputted. Therefore, originally, when coding 2b, the all skip B picture which makes the backward top field the reference destination is outputted. Drawing 15 (c) shows the case of M(I or appearance cycle of P picture) = 3. Since the frame 2 is B picture, the field usable as a reference field is set to 1t, 1b, 4t, and 4b. Since 2 t and 2b have 1b and the near display order, 1b becomes a reference field.

[0072]Therefore, originally, when coding 2 t and 2b, the all skip B picture which makes the forward's bottom field the reference destination, respectively is outputted. Drawing 16 shows the field referred to in the case of skipping the frame 3. Drawing 16 (a) shows the case of M(I or appearance cycle of P picture) = 1. Since the frame 3 is P picture, the field usable as a reference field serves as 2 t and 2b. Among these, since both 3t and 3b have a display order close to 2b, 2b becomes a reference field of 3t

and 3b.
[0073]Therefore, originally, when coding 3t and 3b, the all skip P picture which makes the forward's bottom field the reference destination is outputted. Drawing 16 (b) shows the case of M(I or appearance cycle of P picture) = 2. Since the frame 3 is P picture, the field usable as a reference field is set to 1t and 1b. Among these, since both 3t and 3b have a display order close to 1b, 1b becomes a reference field of 3t and 3b.
[0074]Therefore, originally, when coding 3t and 3b, the all skip P picture which makes the forward's bottom field the reference destination is outputted. In order that 2 t and 2b may also prevent the inversion of a display order by displaying 1b at the time of 3 t, 2 t and 2b set a reference field to 1b, and perform skip processing. The all skip picture which makes the forward's bottom field the reference destination also in this case is outputted.
[0075]Drawing 16 (c) shows the case of M(I or appearance cycle of P picture) = 3. Since the frame 3 is B picture, the field usable as a reference field is set to 1b, 1t, 4t, and 4b. Among these, since 3t and 3b have a display order close to 4 t, 4 t becomes a reference field of 3t and 3b. Therefore, the all skip B picture which makes the backward top field the reference destination is outputted.
[0076]Drawing 17 shows the reference field in the case of skipping the frame 4 in the case of M(I or appearance cycle of P picture) = 3. Since the frame 4 is P picture, the field usable as a reference field is set to 1t and 1b. Among these, since both 4t and 4b have a display order close to 1b, 1b becomes a reference field of 4t and 4b.
[0077]Therefore, originally, when coding 4t and 4b, the all skip P picture which makes the forward's bottom field the reference destination is outputted. In order that 2 t, 2b, and 3t and 3b may also prevent the inversion of a display order by displaying 1b at the time of 4 t, 2 t, 2b, and 3t and 3b set a reference field to 1b, and perform skip processing. The all skip picture which makes the forward's bottom field the reference destination also in this case is outputted.
(Operation) To the next Operation of the video coding device concerning this embodiment is explained.
[0078]Drawing 18 and drawing 19 are flowcharts in which the operation procedures in M(I or appearance cycle of P picture) = 3 in the video coding device concerning this embodiment are shown. Setting out (S501) of a threshold, and the judgment of whether to skip (S502, S503, S507, S508, S511, S512, S515), Since operation of the coding processing (S504) as an I picture, the coding processing (S509) as a P picture, and the coding processing (S513) as a B picture is the same as that of a 1st embodiment, explanation is omitted.
[0079]Since this embodiment differs in the skip method of the picture shown in S801-S810 from a 1st embodiment, it explains these steps. According to this embodiment, since the frame structure is changed to field structure when skipping, two all skip pictures of the top field and bottom field for one screen are outputted. That is, the skip of a picture is performed twice.
[0080]In the case of VBV<Tb1, in Step S512, the all skip B picture which makes a forward's bottom field a reference destination is twice outputted in Step S807 and Step S808. (Refer to drawing 15 (c) for the example of a reference destination). In the case of VBV<Tb2, in Step S515, the all skip B picture which makes a backward top field a reference destination is twice outputted in Step S809 and Step S810. (Refer to drawing 16 (c) for the example of a reference destination).
[0081]In VBV<Tp, in Step S508, the all skip P picture which makes a forward's bottom field a reference destination is twice outputted in Steps S801 and S802 (refer to drawing 17 for the example of a reference destination). And in Steps S803-S806, the all skip B picture which makes a forward's bottom field a reference destination is outputted instead of B picture between skipped P picture and I picture of the reference destination, respectively (refer to drawing 17 for the example of a reference destination).
[0082]And the bit yield of the bit yield of the picture which the receive buffer accumulated dose prediction means 124 generated in Step S505, two pieces, or six all skip pictures, The prediction accumulated dose VBV of the receive buffer before the decryption in a following DTS time is computed with the amount R of transmitted bits for every DTS time interval.
(Conclusion) According to the video coding device applied to this embodiment as mentioned above. When one frame is being assigned to one picture (frame structure) and the prediction accumulated dose of a receive buffer becomes less than a threshold, Since the all skip picture of the field structure which stopped the coding by the frame structure of image data, and made the reference destination the field where a display order is the nearest is sent out, Even if it displays with an interlace scanning system, a display order can be prevented from reversing, when coding of image data is skipped.
(Modification) Although it judged whether a picture would be skipped or not in the video coding device concerning this embodiment based on the prediction accumulated dose of a receive buffer, it does not

limit to this. For example, it is good also as what judges whether a picture is skipped or not based on the accumulated dose of the output buffer by the side of a video coding device.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The composition of the video coding device 100 is shown.
[Drawing 2]Drawing 2 (a) shows an order of a video image from the first. Drawing 2 (b) shows the encoding order of a video image.
[Drawing 3]Drawing 3 (a) shows the prediction accumulated dose of the receive buffer at the time of usual [which does not skip a picture]. Drawing 3 (b) shows the prediction accumulated dose of a receive buffer when a picture is skipped.
[Drawing 4]The example of setting out of a threshold is shown.
[Drawing 5]Drawing 5 (a) shows the prediction accumulated dose of the receive buffer in the case of skipping I picture. Drawing 5 (b) shows the prediction accumulated dose of the receive buffer in the case of skipping B1 picture. Drawing 5 (c) shows the prediction accumulated dose of the receive buffer in the case of skipping B-2 picture. Drawing 5 (d) shows the prediction accumulated dose of the receive buffer in the case of skipping P picture.
[Drawing 6]Drawing 6 (a) shows the example of the screen usually displayed with a decoding device. Drawing 6 (b) shows the example of the screen displayed with a decoding device, when a picture is skipped.
[Drawing 7]It is a flowchart in which the operation procedures of the video coding device concerning a 1st embodiment are shown.
[Drawing 8]The example of setting out of a threshold is shown.
[Drawing 9]It is a figure explaining the threshold of B picture in front of P picture.
[Drawing 10]Drawing 10 (a) shows transition of the prediction accumulated dose of the receive buffer in the threshold in a 1st embodiment. Drawing 10 (b) shows transition of the prediction accumulated dose of the receive buffer in the threshold in a 2nd embodiment.
[Drawing 11]Drawing 11 (a) shows the example of the screen usually displayed with a decoding device. Drawing 11 (b) shows the example of the screen displayed with a decoding device, when the skip of a picture is judged with the threshold of a 1st embodiment. Drawing 11 (c) shows the example of the screen displayed with a decoding device, when the skip of a picture is generated in the threshold of a 2nd embodiment. Drawing 11 (d) shows the example of the screen displayed with a decoding device, when the skip of a picture is generated in the threshold of a 2nd embodiment.
[Drawing 12]The example of setting out of a threshold is shown.
[Drawing 13]It is a figure explaining the threshold of B picture in front of P picture.
[Drawing 14]The picture header of the picture layer of an all skip B picture and picture encoding extension are shown.
[Drawing 15]Drawing 15 (a) shows the case of M(I or appearance cycle of P picture) = 1. Drawing 15 (b) shows the case of M(I or appearance cycle of P picture) = 2. Drawing 15 (c) shows the case of M(I or appearance cycle of P picture) = 3.
[Drawing 16]Drawing 16 (b) which drawing 16 (a) shows the case of M(I or appearance cycle of P picture) = 1 shows the case of M(I or appearance cycle of P picture) = 2. Drawing 16 (c) shows the case of M(I or appearance cycle of P picture) = 3.
[Drawing 17]The reference field in the case of skipping the frame 4 in the case of M(I or appearance cycle of P picture) = 3 is shown.
[Drawing 18]It is a flowchart in which the operation procedures of the video coding device concerning a 3rd embodiment are shown.
[Drawing 19]It is a flowchart in which the operation procedures of the video coding device concerning a 3rd embodiment are shown.

[Drawing 20]Drawing 20 (a) shows usual transition of the prediction accumulated dose of a receive buffer. Drawing 20 (b) shows the example in which the prediction accumulated dose of a receive buffer carries out underflow. Drawing 20 (c) shows the example which the prediction accumulated dose of a receive buffer overflows.
[Drawing 21]Drawing 21 (a) shows the example of the screen usually displayed sometimes. Drawing 21 (b) shows the example of the screen displayed when a skip DOMAKU lob lock is used. Drawing 21 (c) shows the example of the screen displayed when a pseudo image is used.
[Drawing 22]The composition of the video coding device indicated to JP,2871316,B is shown.
[Drawing 23]Drawing 23 (a) shows the display screen at the time of usual [which does not skip a picture]. Drawing 23 (b) shows the display screen at the time of being generated by the skip of a picture.
[Description of Notations]
6 Orthogonal transformation circuit
20 Buffer memory
22 SKIP code storing memory
24 Transmission rate excess decision circuit
100 Video coding device
110 Screen rearranging means
111 Adding machine
112 Adding machine
113 DCT means
114 Quantization means
115 Rate control means
116 Variable-length-coding means
117 Buffer
118 Change machine
119 Inverse quantization means
120 Reverse DCT means
121 Buffer memory
122 Video memory
123 Motion-compensation-prediction means
124 Receive buffer accumulated dose prediction means
125 Comparison judging means
126 SKIP picture storing memory
127 Threshold setting means

[Translation done.]

DRAWINGS

[Drawing 4]

$$\begin{aligned} Ti &= Ei \\ Tp &= Ep \\ Tb2 &= Eb \\ Tb1 &= Eb \end{aligned}$$

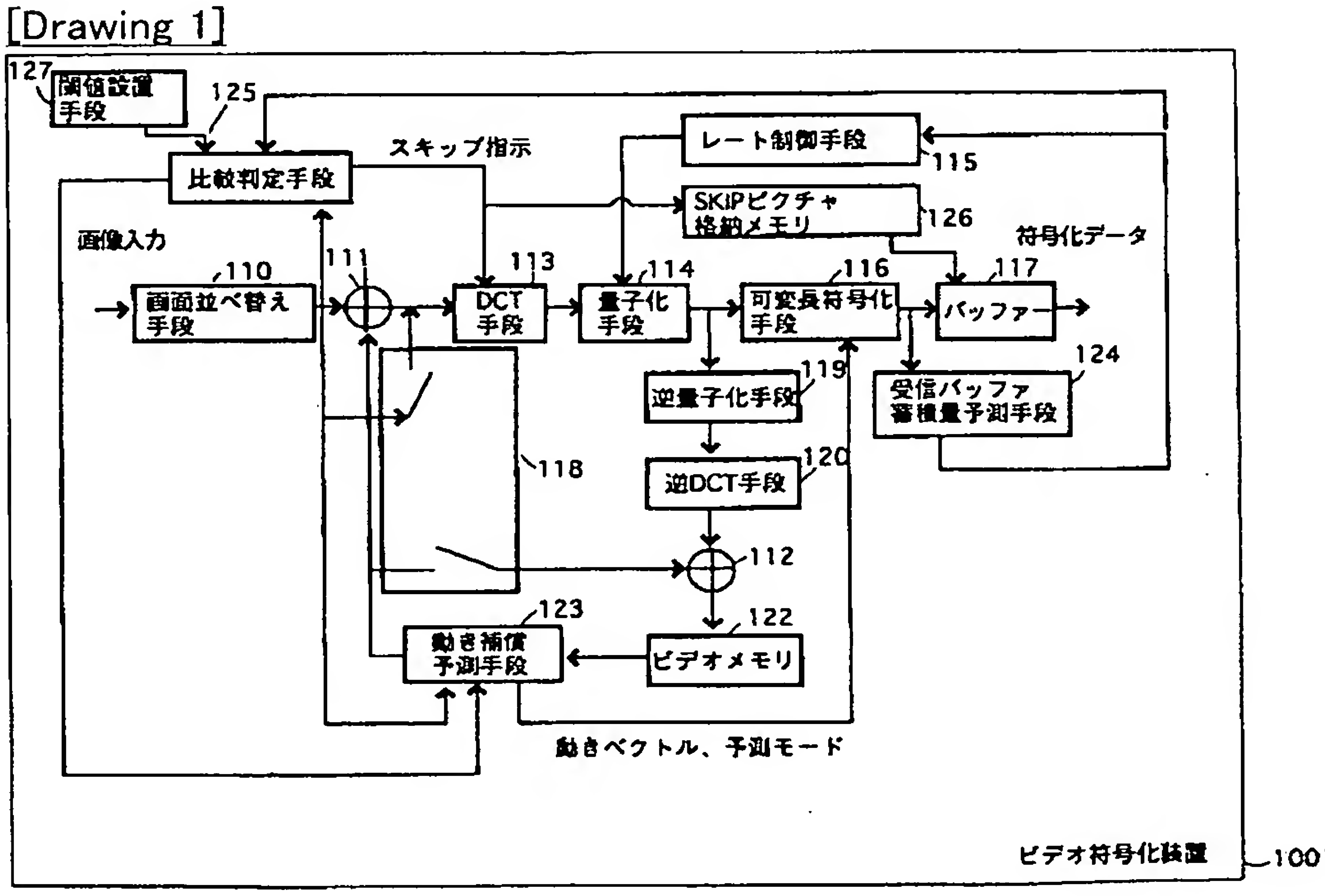
[Drawing 8]

$$\begin{array}{ll} Ti=Ei & \\ Tp=Ep & \\ Tb2(p)=Eb+(Ep-R) & (Ep-R)\geqq 0 \\ \quad =Eb & (Ep-R)<0 \\ Tb1(p)=Eb+(Tb2(p)-R) & (Tb2(p)-R)\geqq 0 \\ \quad =Eb & (Tb2(p)-R)<0 \\ Tb2(i)=Eb+(Ei-R) & (Ei-R)\geqq 0 \\ \quad =Eb & (Ei-R)<0 \\ Tb1(i)=Eb+(Tb2(i)-R) & (Tb2(i)-R)\geqq 0 \\ \quad =Eb & (Tb2(i)-R)<0 \end{array}$$

[Drawing 12]

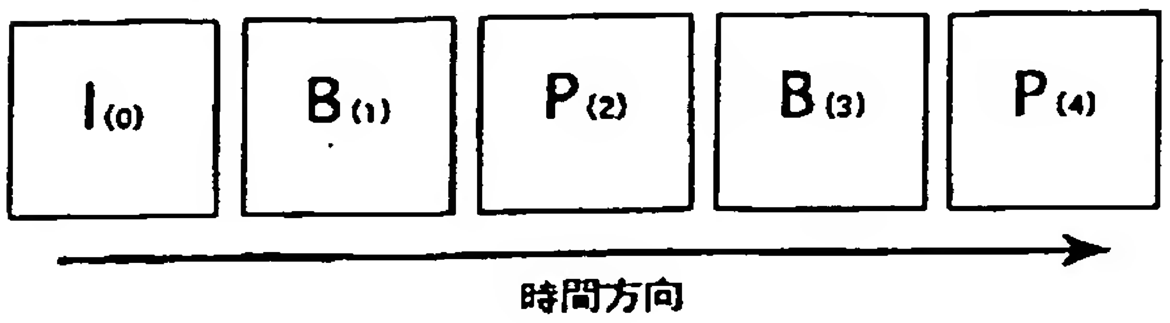
$$\begin{array}{ll} Ti=Ei & \\ Tp=Ep & \\ Tb2(p)=Eb+(Ep-R) & (Ep-R)\geqq 0 \\ \quad =Eb & (Ep-R)<0 \\ Tb1(p)=Dbskip+(Tb2(p)-R) & (Dbskip+(Tb2(p)-R))\geqq Eb \\ \quad =Eb & (Dbskip+(Tb2(p)-R))<Eb \\ Tb2(i)=Eb+(Ei-R) & (Ei-R)\geqq 0 \\ \quad =Eb & (Ei-R)<0 \\ Tb1(i)=Dbskip+(Tb2(i)-R) & (Dbskip+(Tb2(i)-R))\geqq Eb \\ \quad =Eb & (Dbskip+(Tb2(i)-R))<Eb \end{array}$$

[Drawing 1]

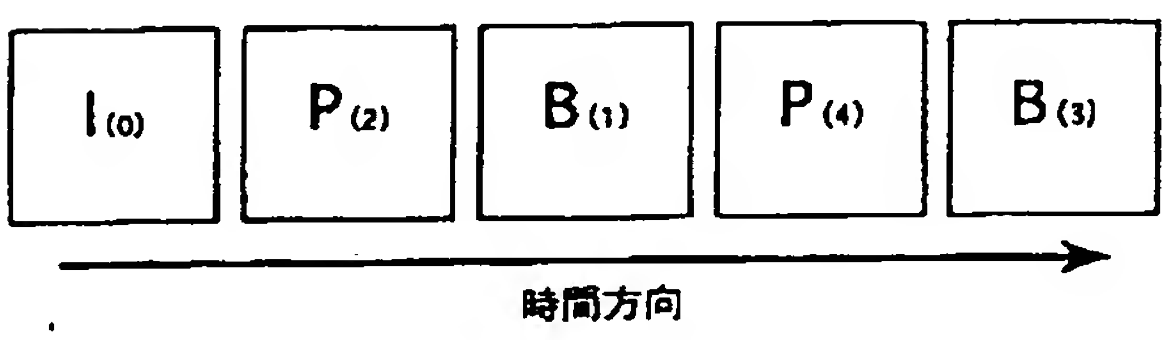


[Drawing 2]

(a) 原画像の順序

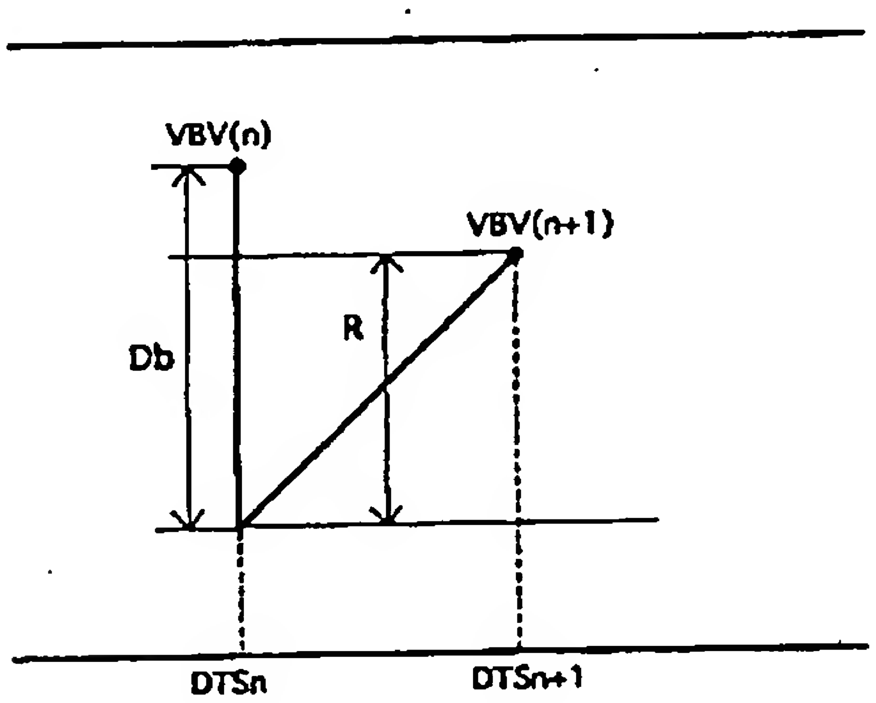


(b) 符号化の順序

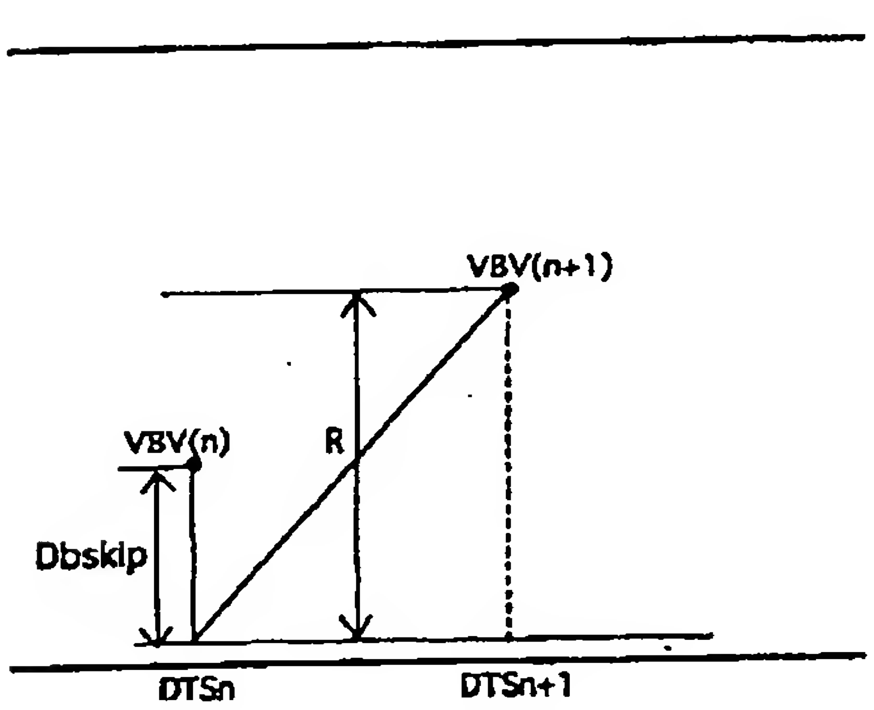


[Drawing 3]

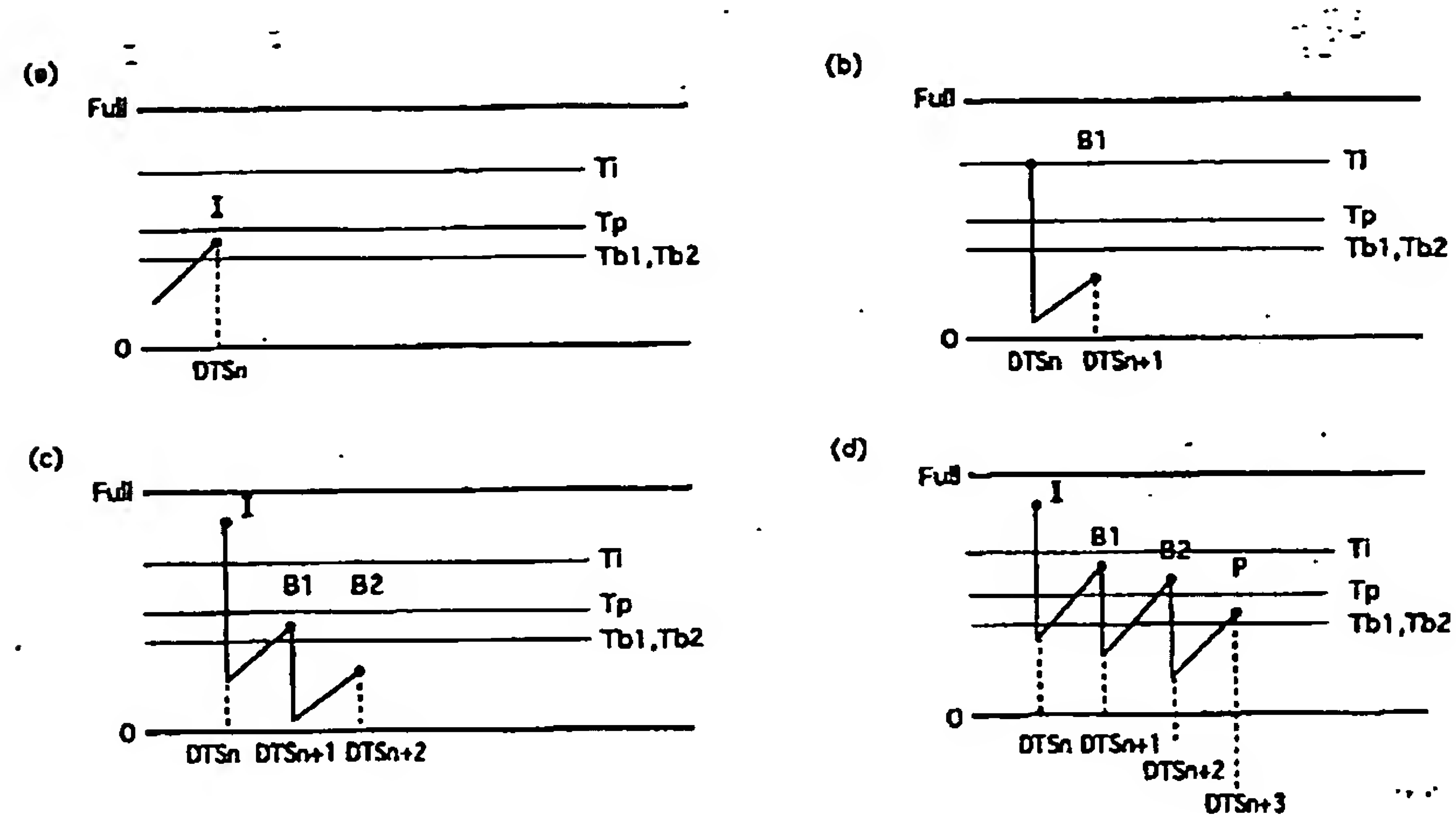
(a)



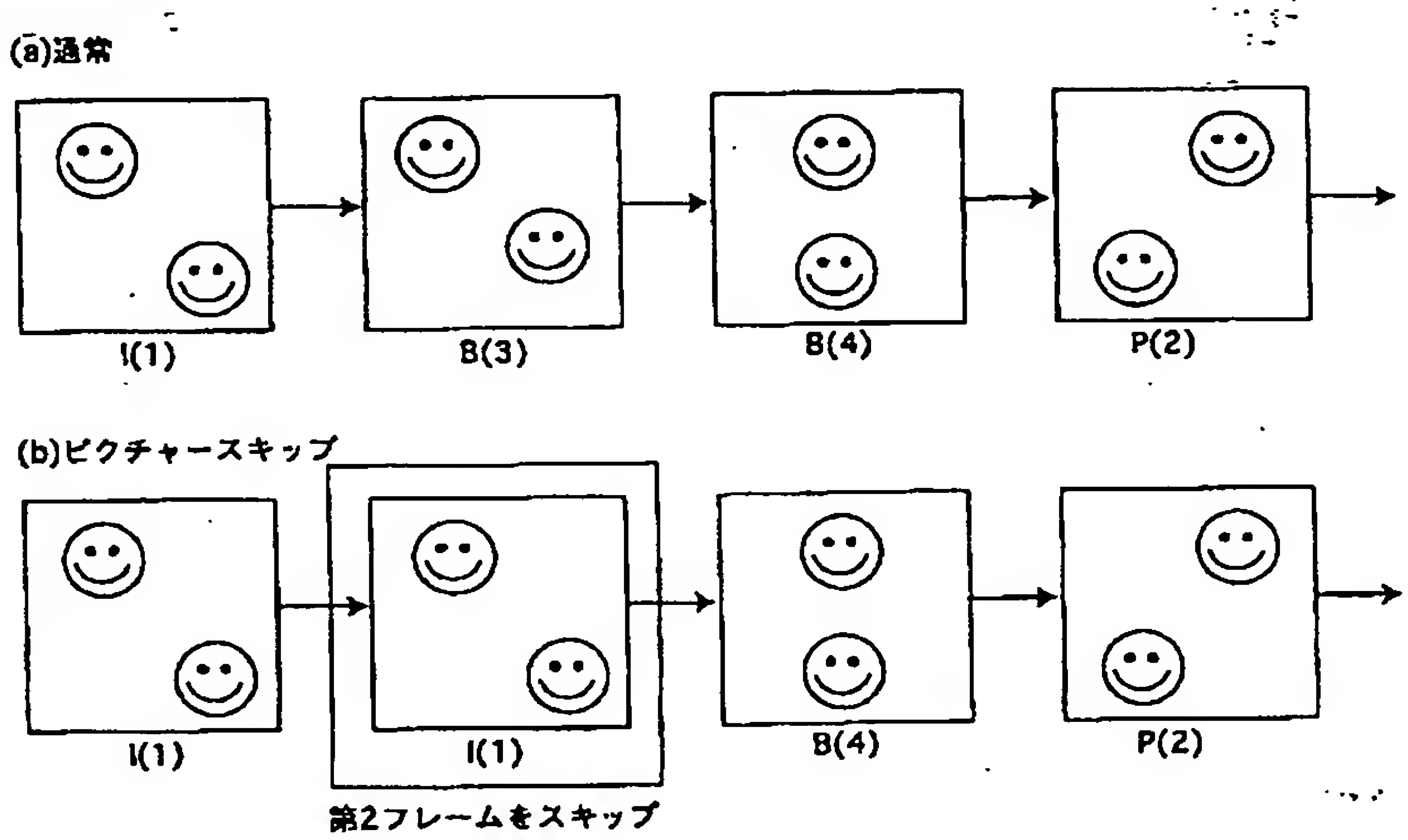
(b)



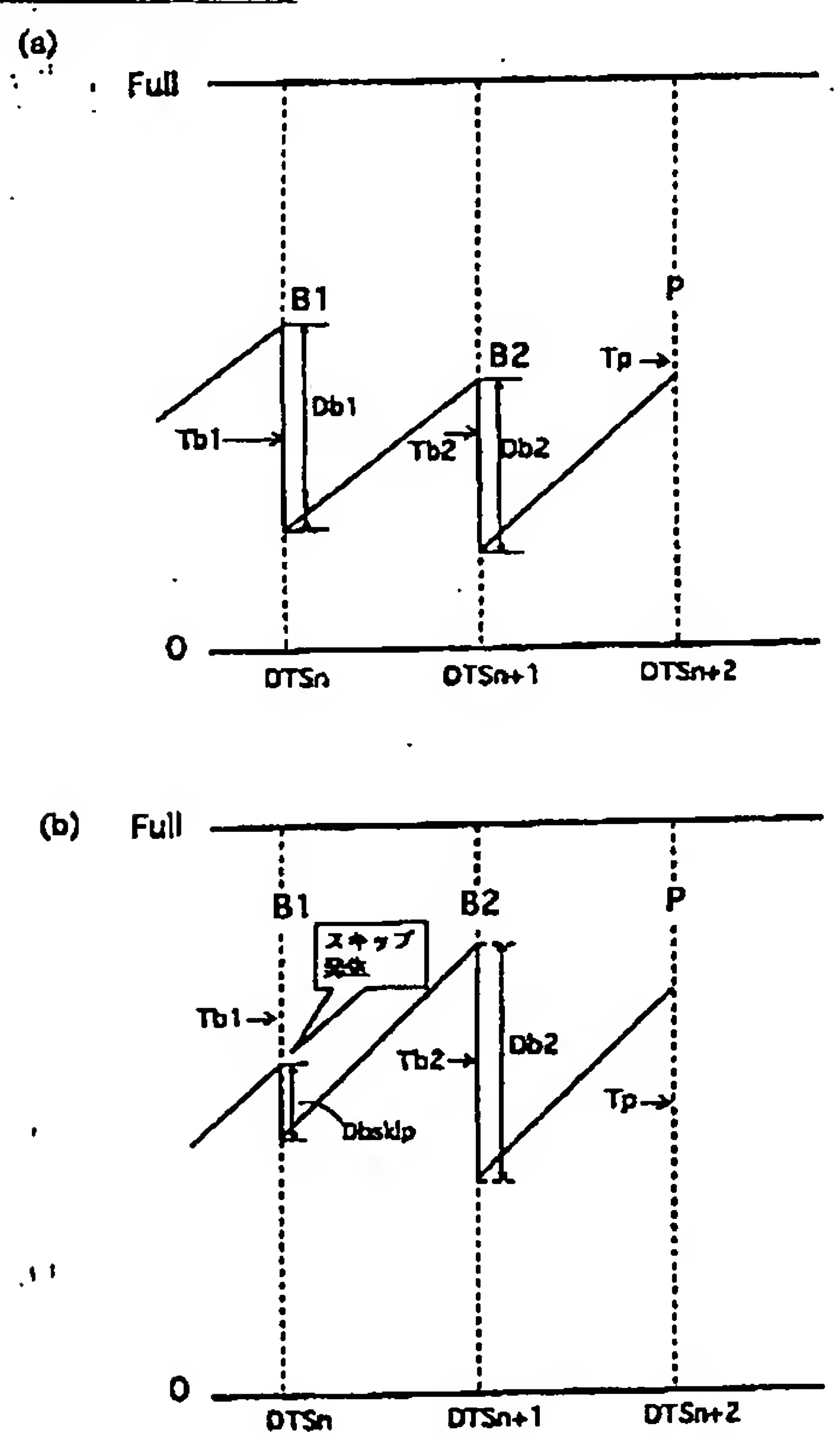
[Drawing 5]



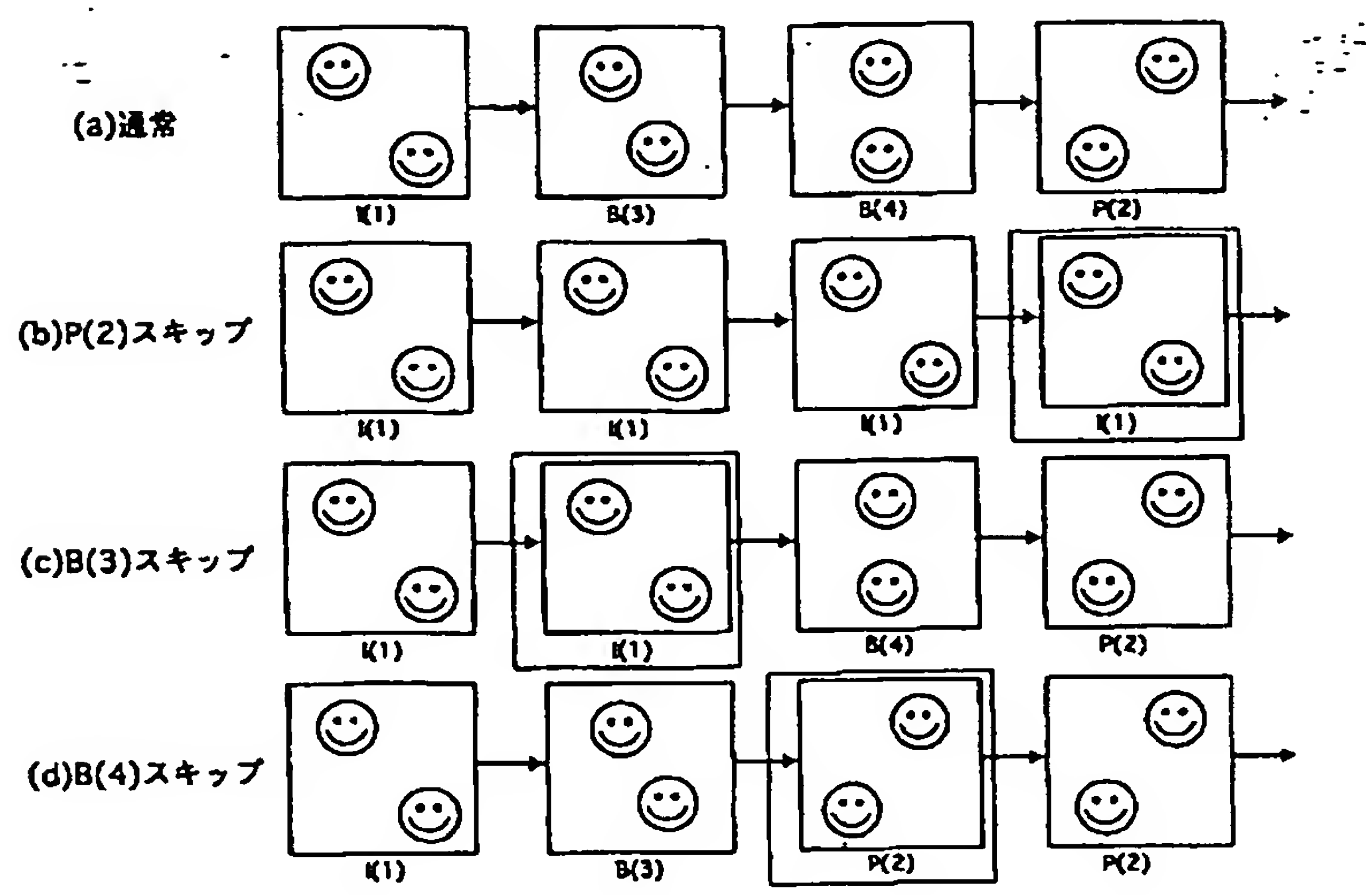
[Drawing 6]



[Drawing 10]



[Drawing 11]



[Drawing 14]

MPEG2のビットストリーム構造（Bピクチャ）

Picture header

temporal_reference

picture_coding_type=3(I=1、P=2、B=3)

vbv_delay=65535

full_pel_forward_vector=0

forward_f_code=7

picture coding extension

forward horizontal f_code=2

forward vertical f_code=2

forward horizontal f_code=15

forward vertical f_code=15

intra_dc_precision=0

1

$\boxed{\text{picture\_structure=1(TopField=1,BottomField=2,Frame=3)}}$

top_field_first=0

frame_pred_frame_dct=0

concealment_motion_vectors=0

q_scale_type=1

intra_vlc_format=0

alternate_scan=0

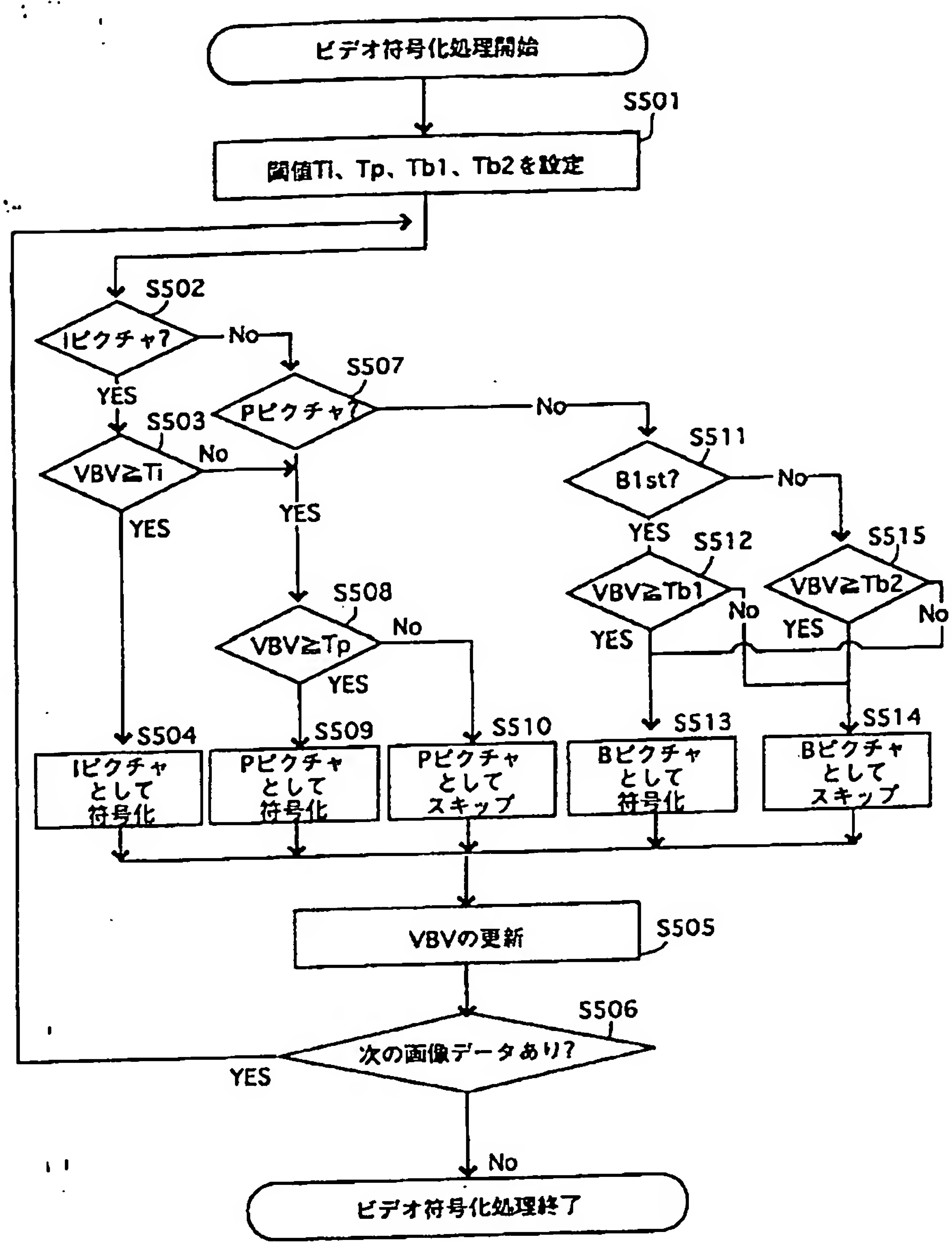
repeat_first_field=0

chroma_420_type=0

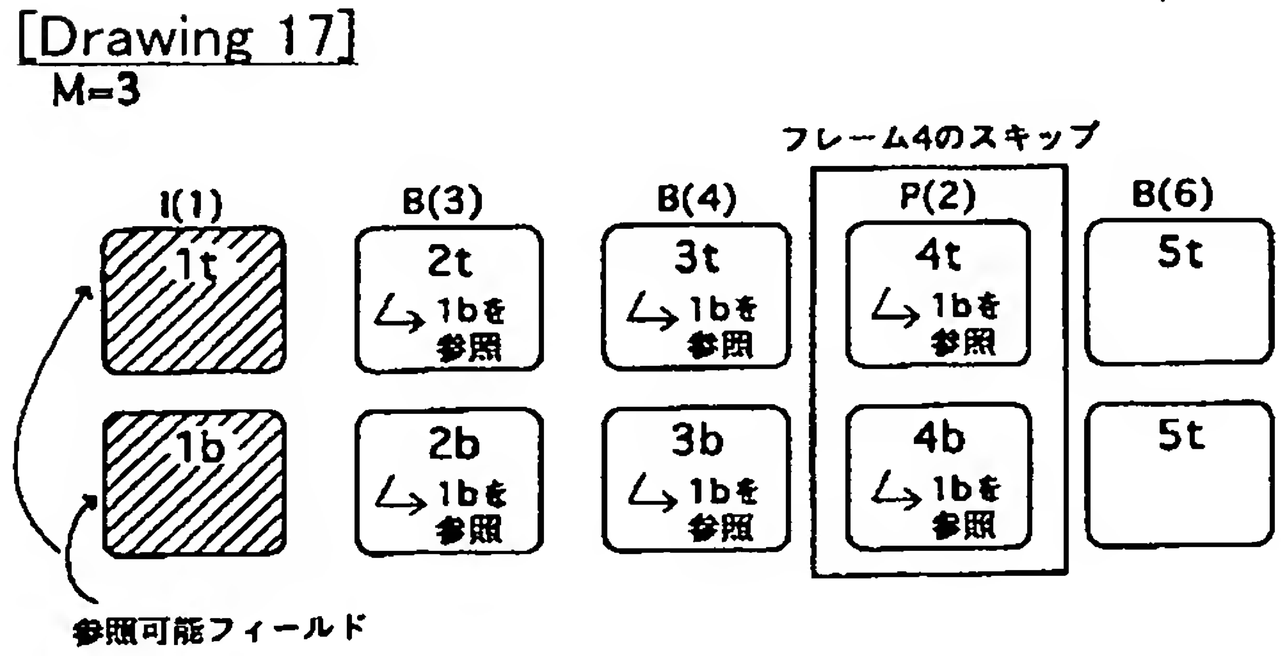
progressive_frame=0

composite_display_flag=0

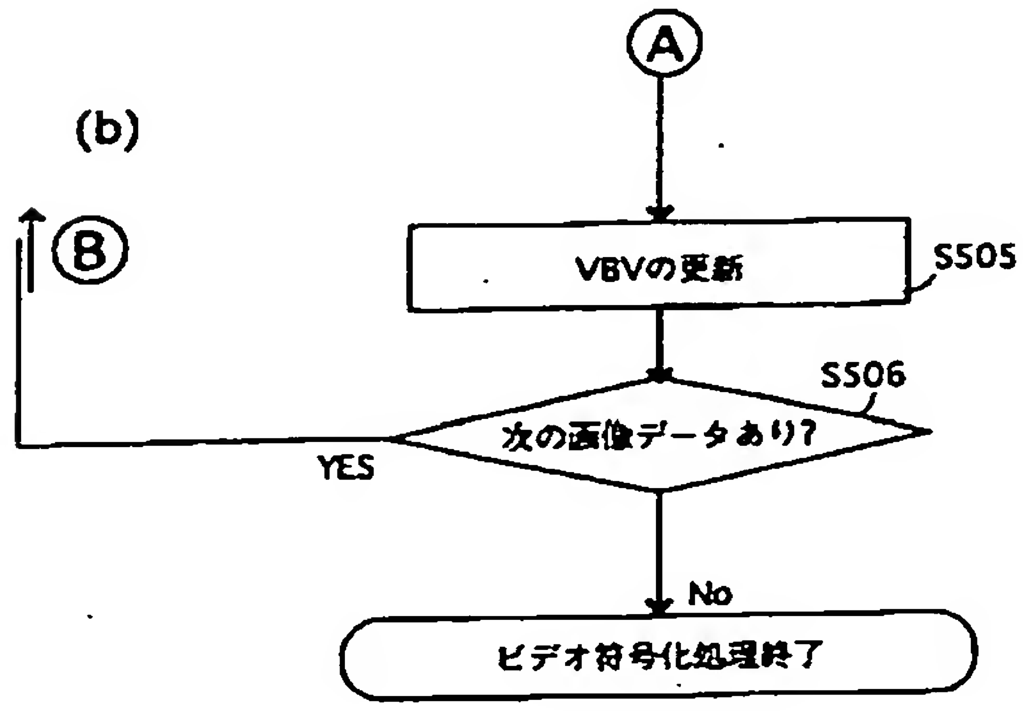
[Drawing 7]



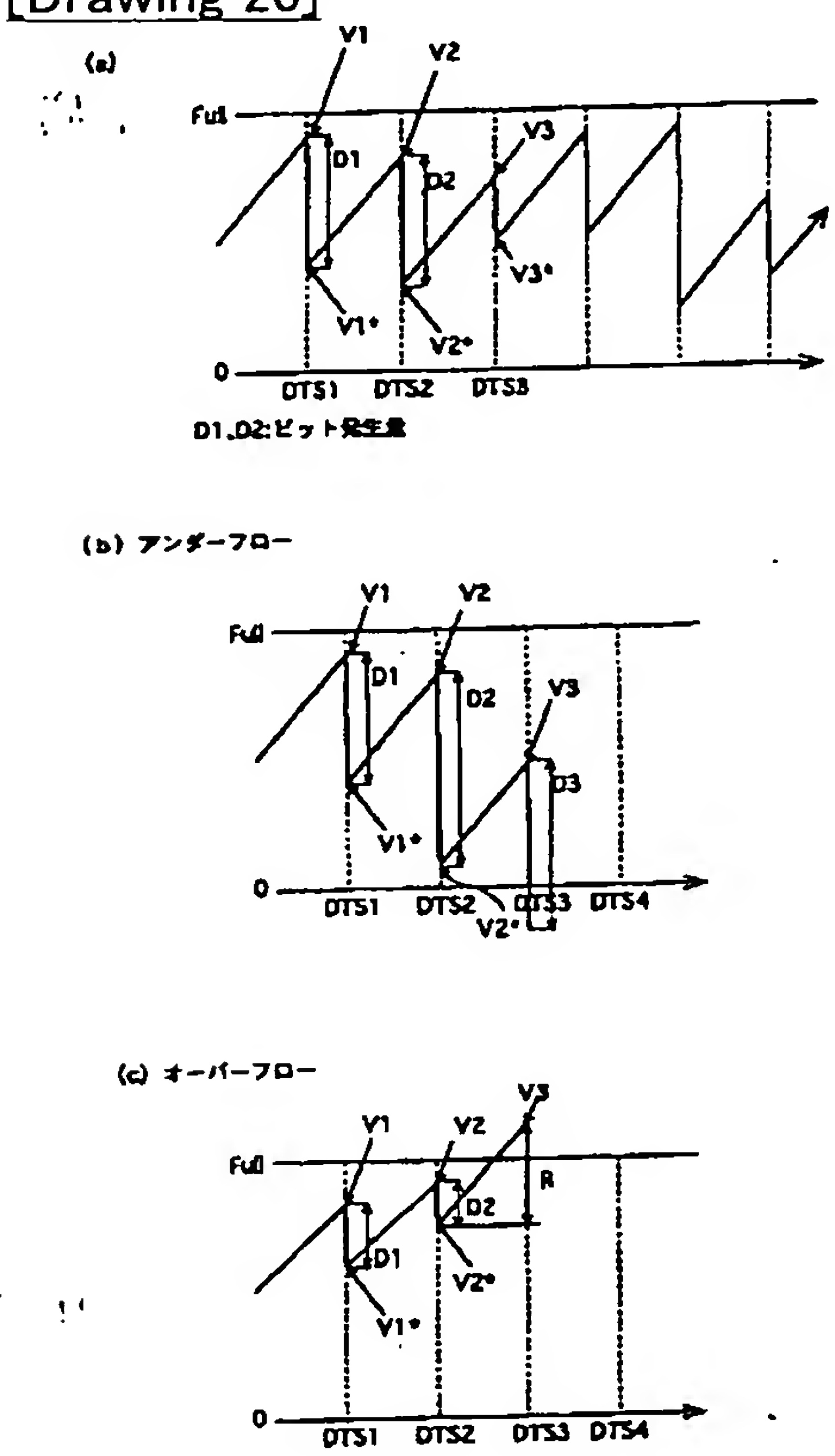
[Drawing 17]



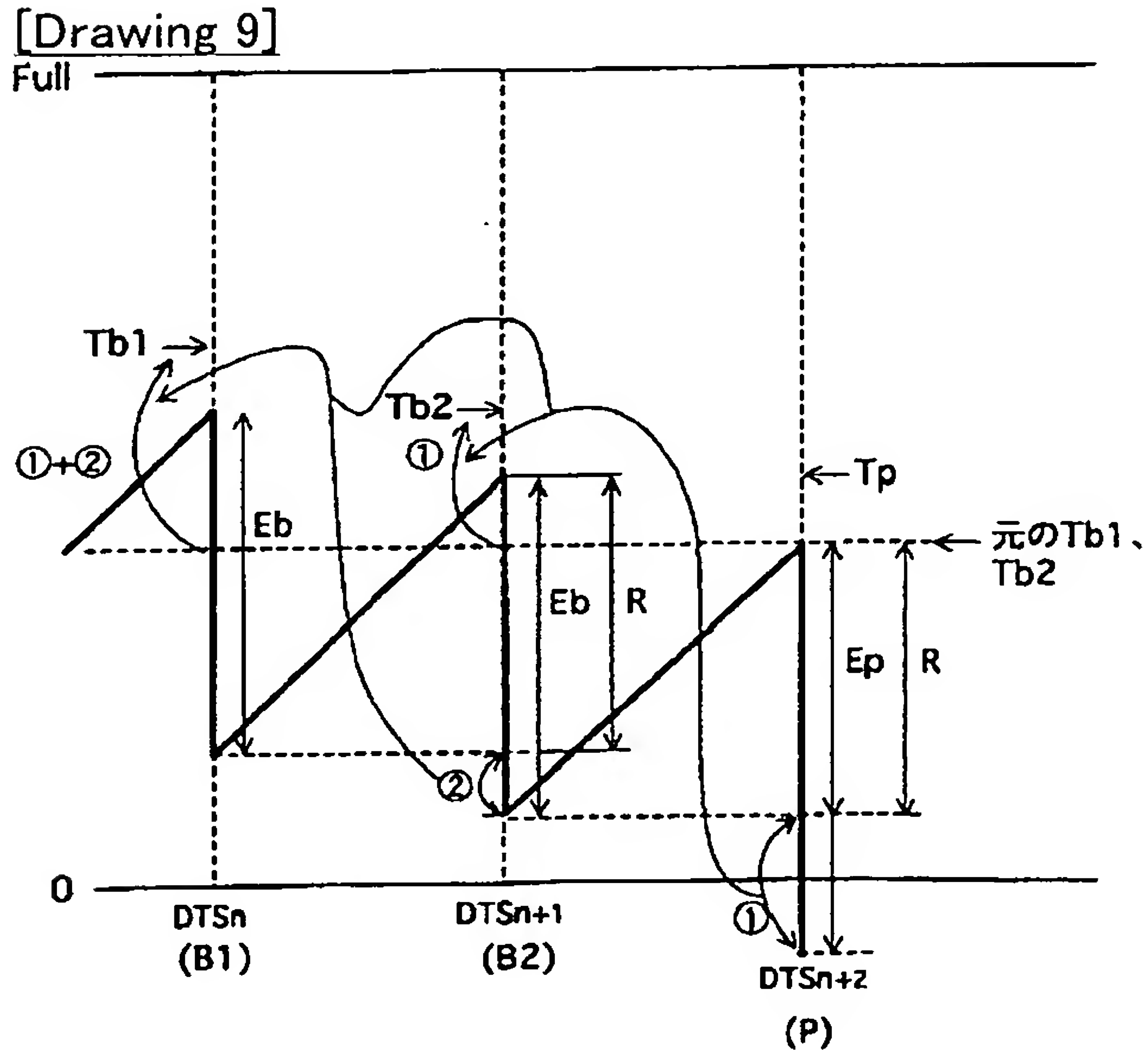
[Drawing 19]



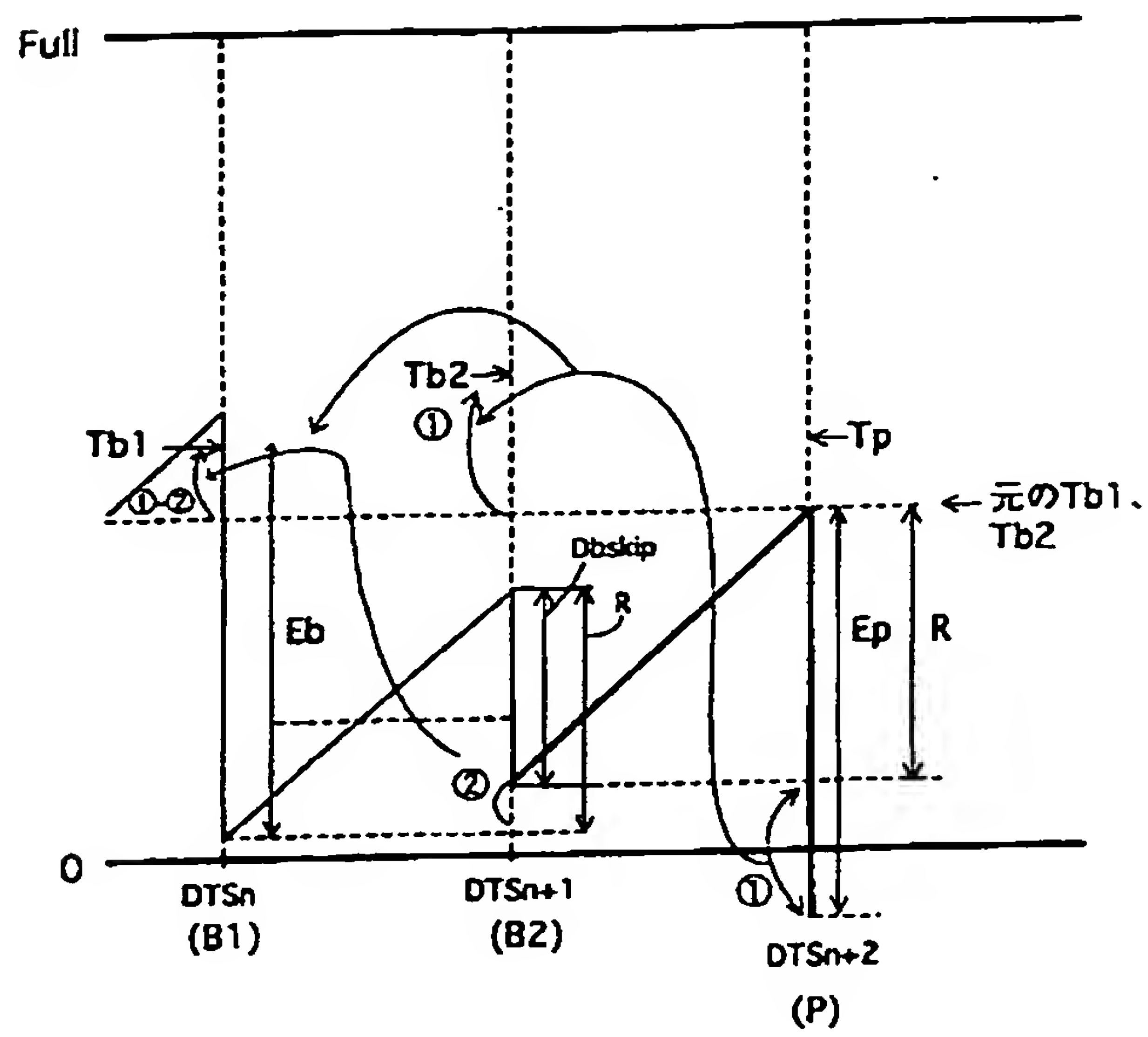
[Drawing 20]



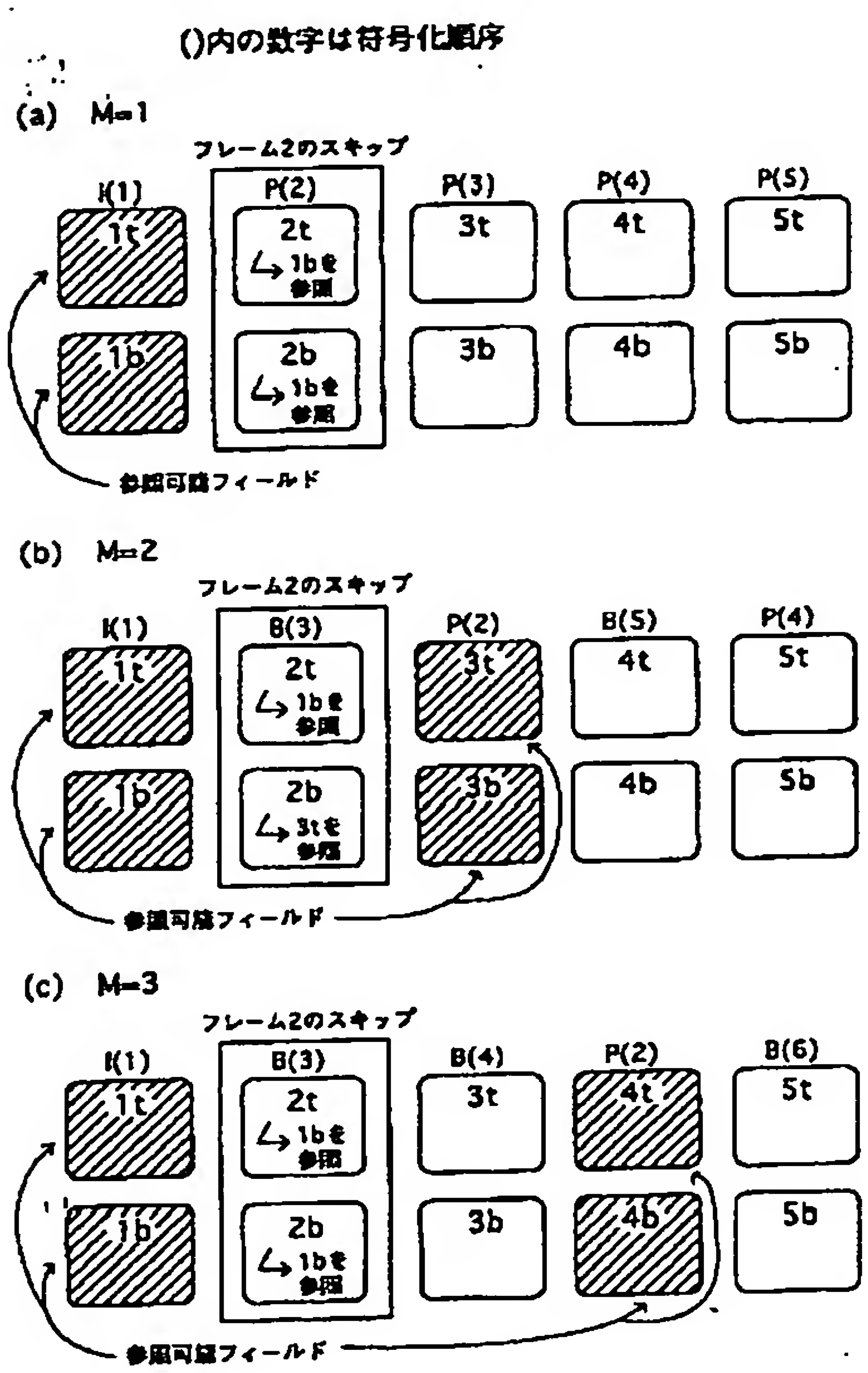
[Drawing 9]



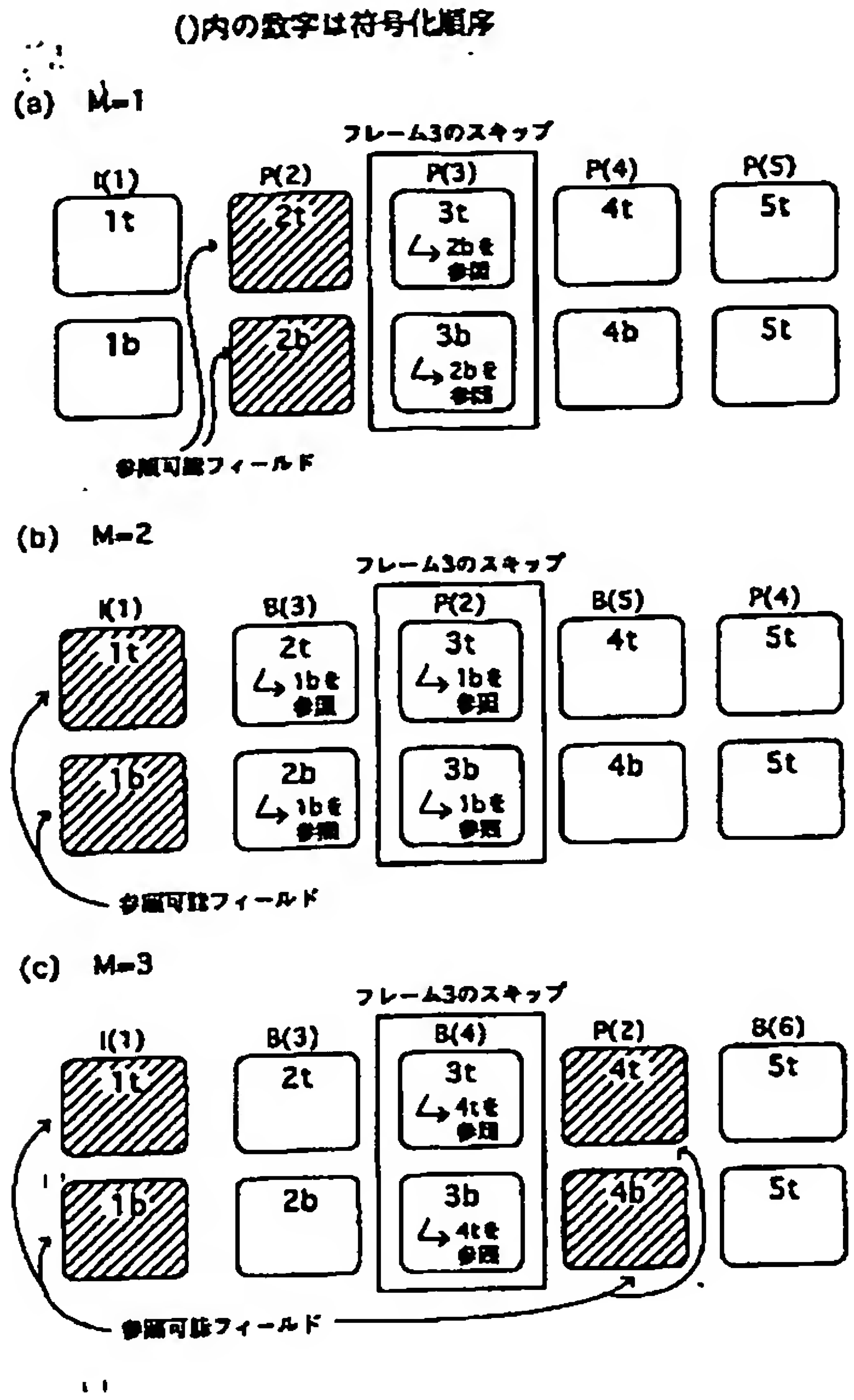
[Drawing 13]



[Drawing 15]

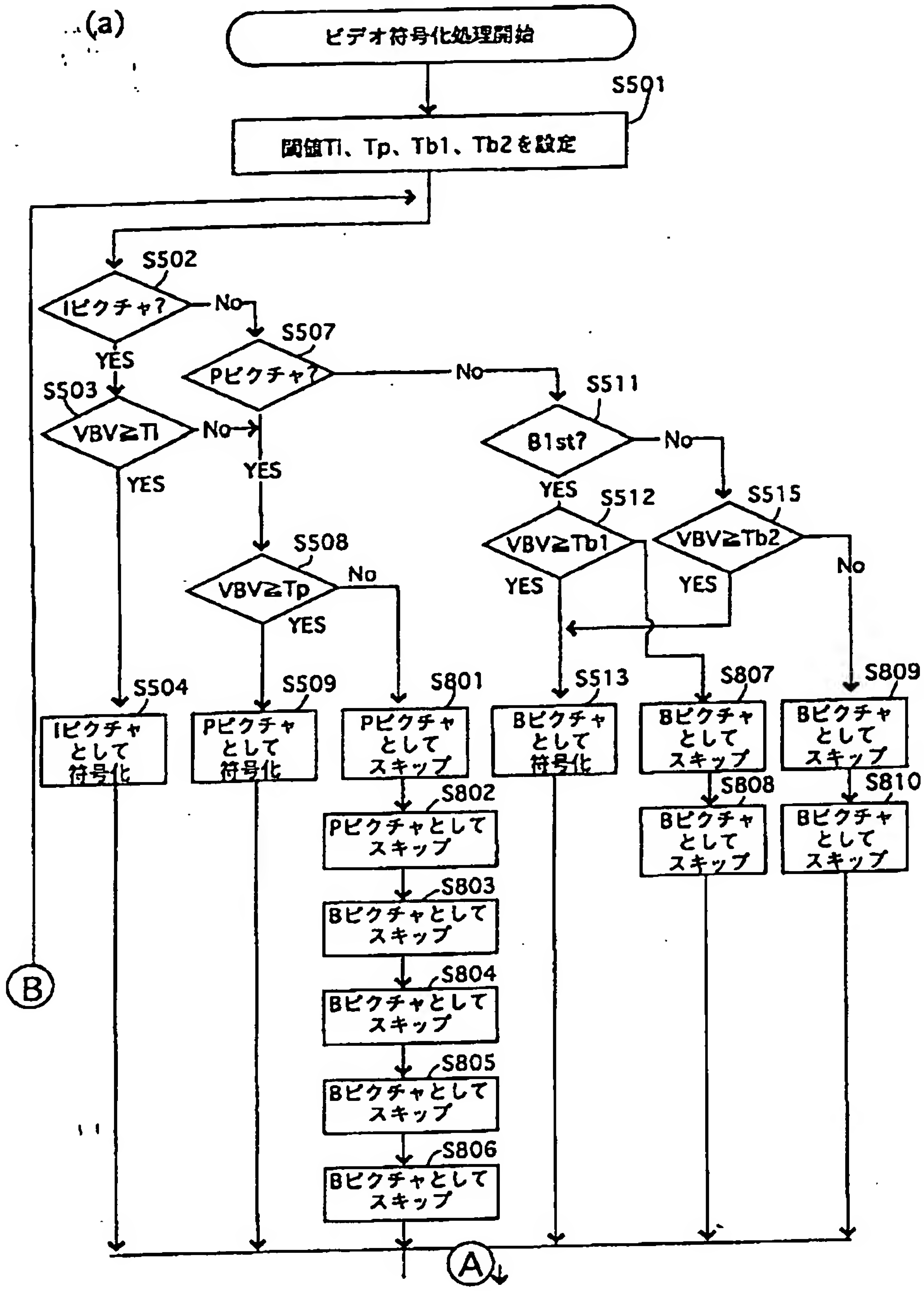


[Drawing 16]


()内の数字は符号化順序
(a) M=1
フレーム3のスキップ
I(1)
P(2)
P(3)
P(4)
P(5)
1t
2t
3t
2bを参照
4t
5t
1b
2b
3b
2bを参照
4b
5t
参照可能フィールド
(b) M=2
フレーム3のスキップ
I(1)
B(3)
P(2)
B(5)
P(4)
1t
2t
1bを参照
3t
1bを参照
4t
5t
1b
2b
1bを参照
3b
1bを参照
4b
5t
参照可能フィールド
(c) M=3
フレーム3のスキップ
I(1)
B(3)
B(4)
P(2)
B(6)
1t
2t
3t
4tを参照
4t
5t
1b
2b
3b
4tを参照
4b
5t
参照可能フィールド

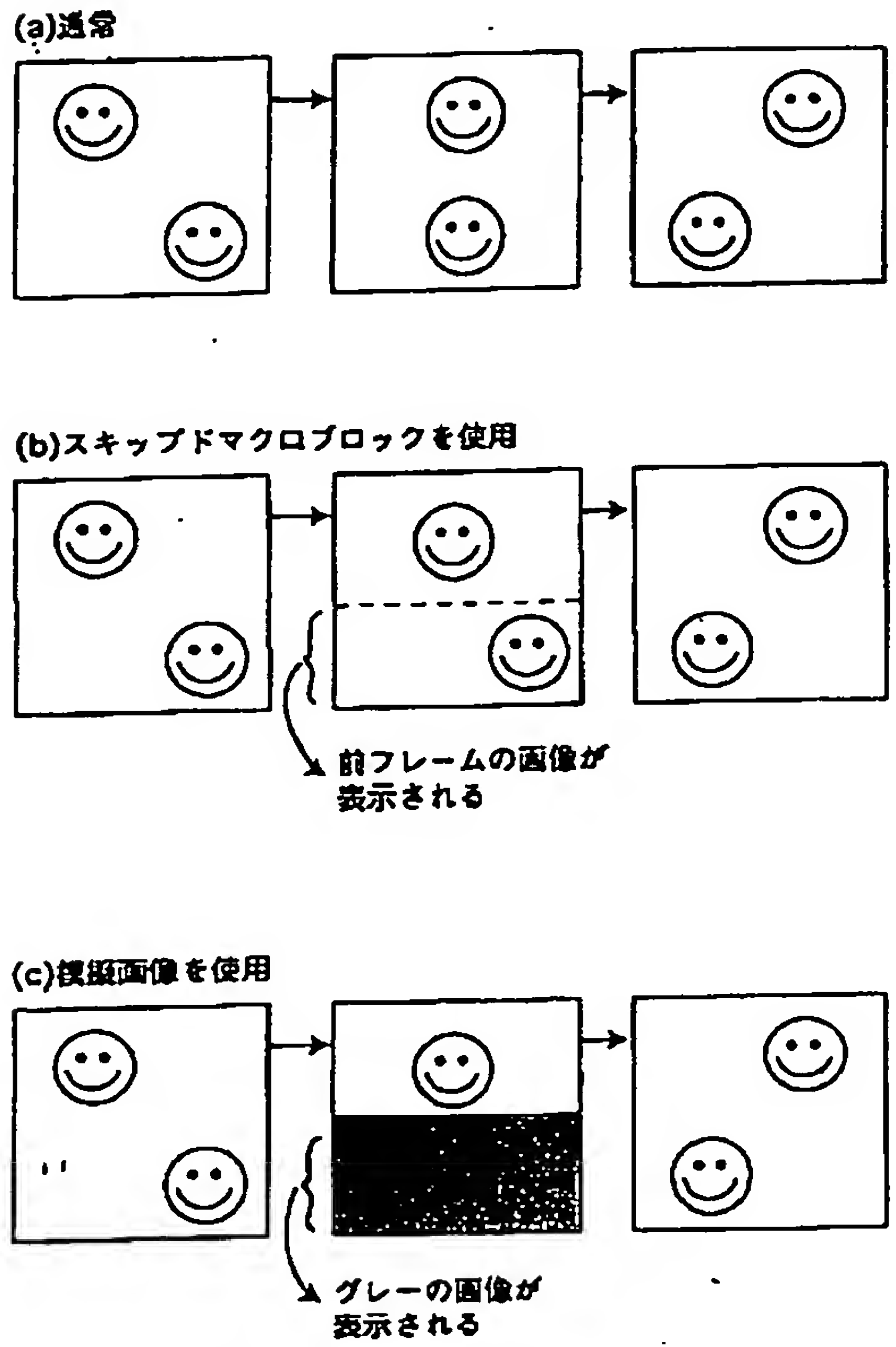
[Drawing 18]

(a)

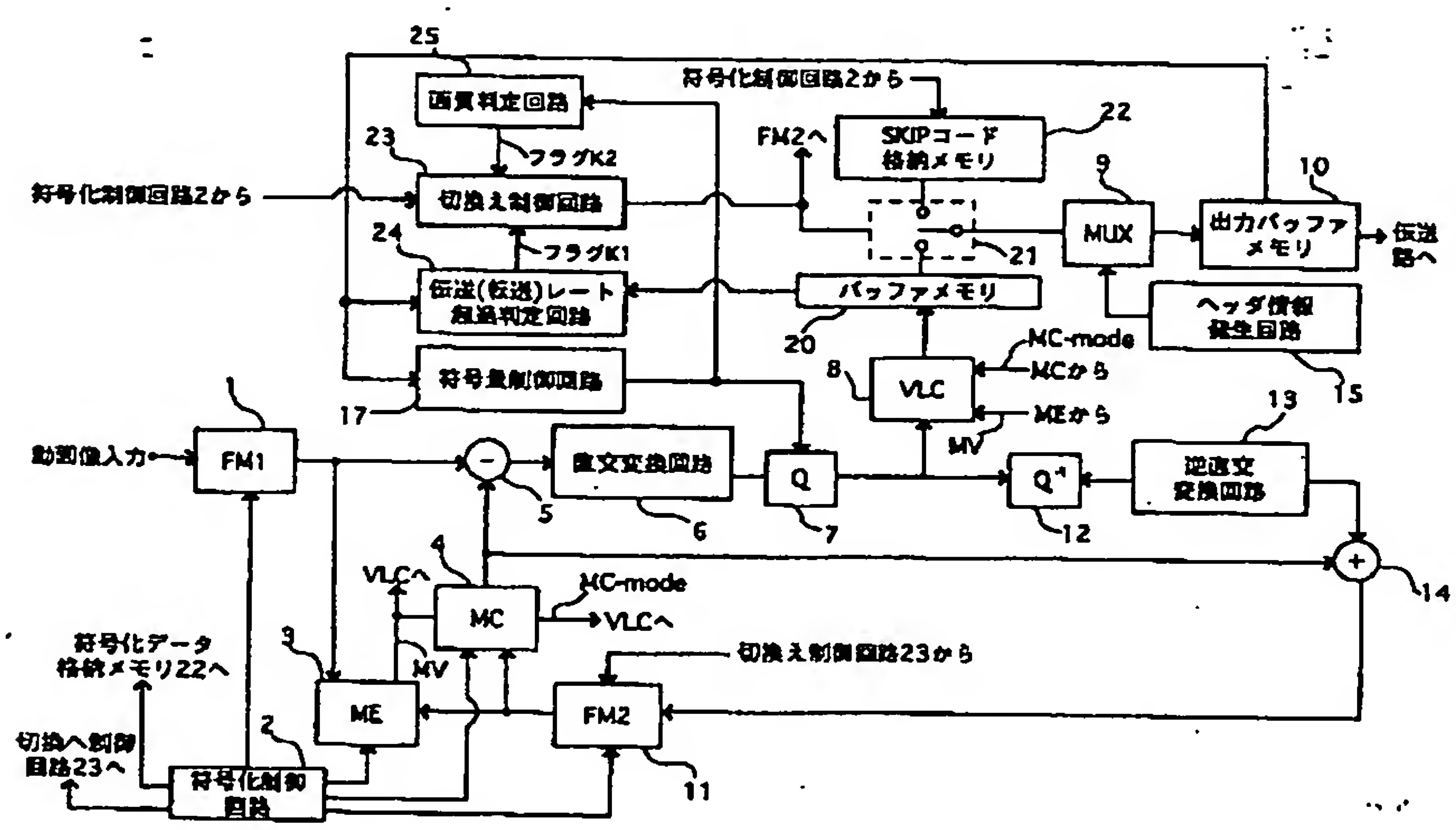

ビデオ符号化処理開始
S501
閾値Ti、Tp、Tb1、Tb2を設定
S502
Iピクチャ?
No
YES
S503
VBV≧Ti
YES
S507
Pピクチャ?
No
YES
S508
VBV≧Tp
No
YES
S511
B1st?
No
YES
S512
VBV≧Tb1
YES
S515
VBV≧Tb2
YES
No
S504
Iピクチャとして符号化
S509
Pピクチャとして符号化
S801
Pピクチャとしてスキップ
S802
Pピクチャとしてスキップ
S803
Bピクチャとしてスキップ
S804
Bピクチャとしてスキップ
S805
Bピクチャとしてスキップ
S806
Bピクチャとしてスキップ
S513
Bピクチャとして符号化
S807
Bピクチャとしてスキップ
S808
Bピクチャとしてスキップ
S809
Bピクチャとしてスキップ
S810
Bピクチャとしてスキップ
B
A

[Drawing 21]

http://www4.ipdl.inpit.go.jp/cgi-bin/tran_web_cgi_ejje?atw_u=http%3A%2F%2Fwww4.ipdl.inpit.go.jp%2FTok...

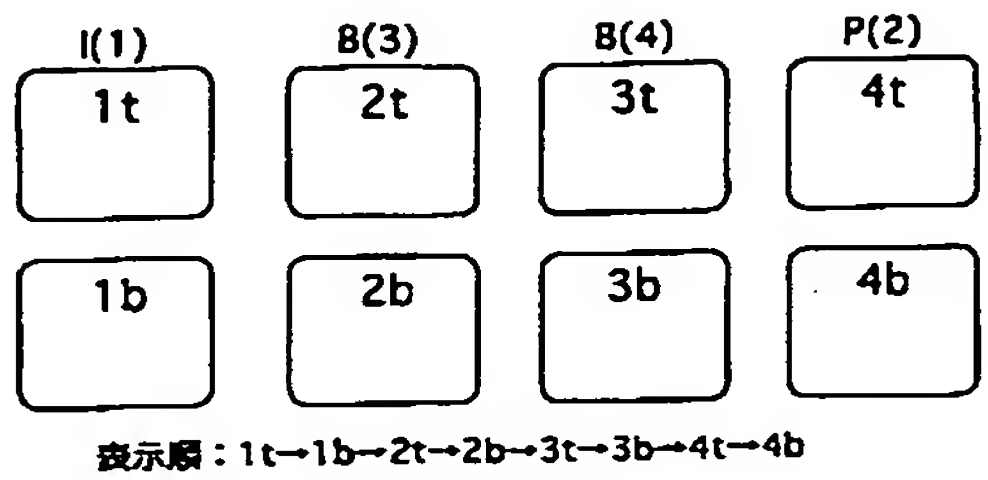


[Drawing 22]

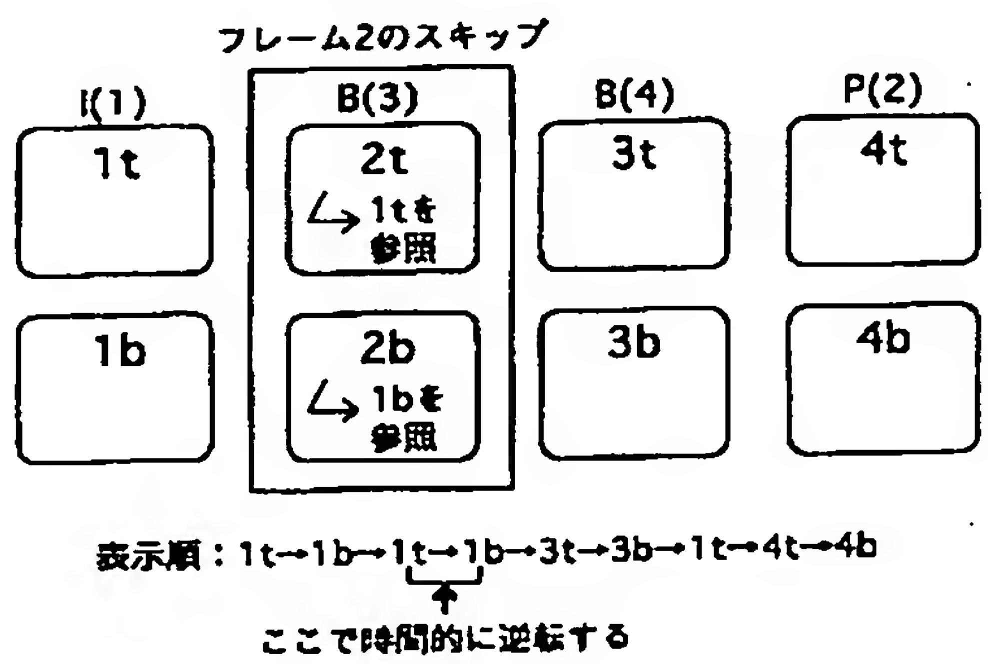


[Drawing 23]

(a)通常



(b) ピクチャ・スキップ



[Translation done.]

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Ｈ０３Ｍ　7/30		7/40	５Ｊ０６４
7/40		Ｈ０４Ｎ　7/137	Ｚ

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(33)優先権主張国　日本（ＪＰ）
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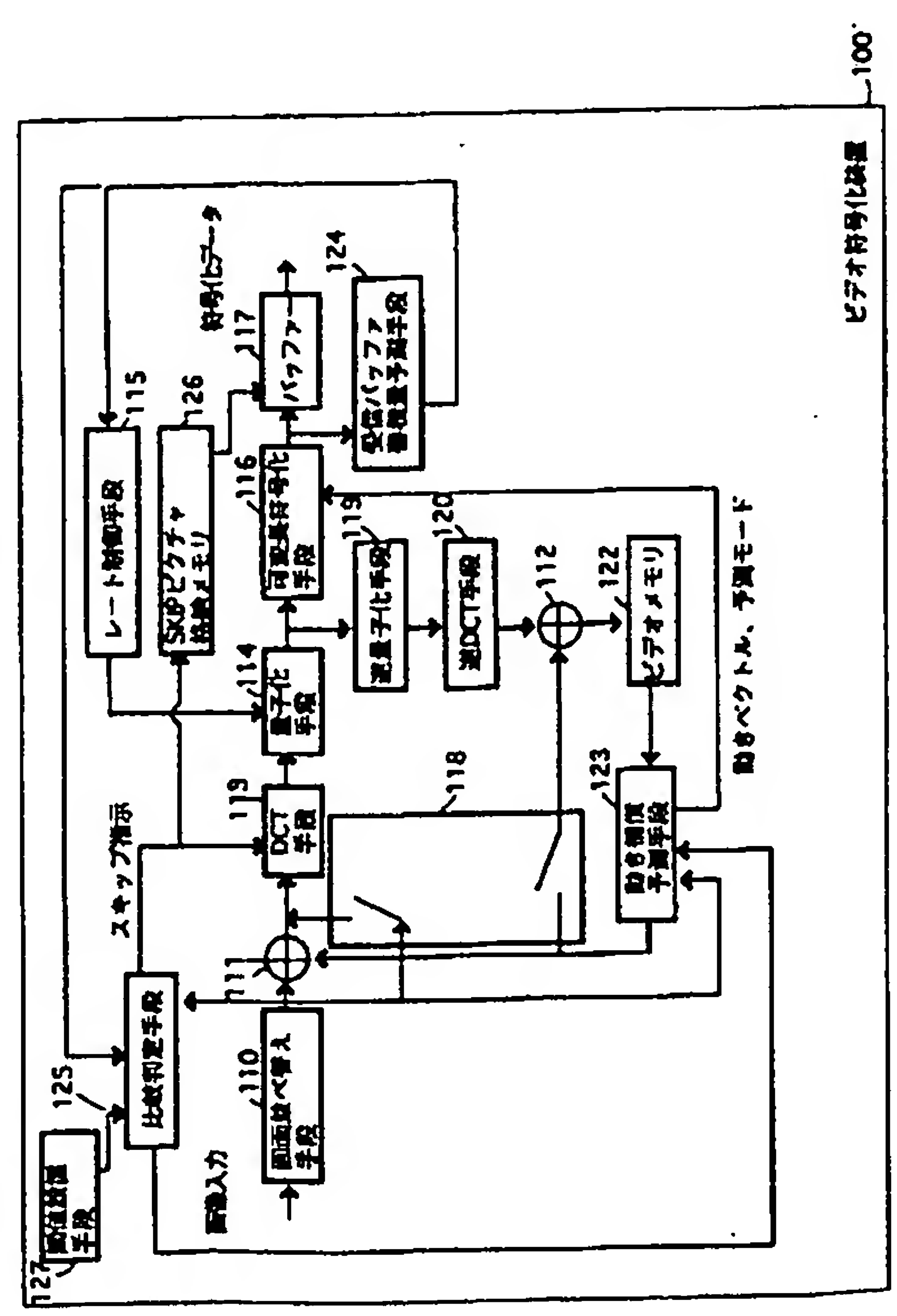
弁理士　中島　司朗
最終頁に続く

(54)【発明の名称】　ビデオ符号化装置

(57)【要約】
【課題】　ピクチャ全体をスキップするか否かを判定するための特別のバッファを不要とするとともに、ピクチャ全体をスキップしたときでも、表示順序が逆転しないビデオ符号化装置を提供する。
【解決手段】　ビデオ符号化装置の比較判定手段１２５は、１画像データごとに、その画像データが符号化される前に、復号化装置の受信バッファの予測蓄積量とピクチャタイプごとに設定された閾値とを比較する。比較判定手段１２５は、受信バッファの予測蓄積量が閾値未満の場合には、画像データの符号化処理をスキップすべきと判定し、ＤＣＴ手段１１３に対して符号化処理を中止させる。そして、比較判定手段１２５は、ＳＫＩＰピクチャ格納メモリ１２６からスライス層の最初と最後を除く残りのすべてのマクロブロックがスキップドマクロブロックで構成されるオールスキップピクチャを出力させる。



【特許請求の範囲】

【請求項１】　復号化装置における受信バッファの蓄積量を予測しながら、１フレーム又は１フィールドの画像データを符号化するビデオ符号化装置であって、
画像データを符号化する前に、当該画像データの符号化データの復号化時刻において受信バッファに蓄積されているであろうと予測される予測蓄積量と、所定の閾値とを比較する比較手段と、
予測蓄積量が閾値未満の場合には、前記画像データの符号化を中止し、前記復号化時刻に受信バッファから取出されるデータとして、前記画像データの符号化データの代わりに、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを用いるスキップ手段と
を備えたことを特徴とするビデオ符号化装置。

【請求項２】　前記ビデオ符号化装置であって、さらに、
画像データが符号化されるピクチャのタイプ（Ｉピクチャ、Ｐピクチャ又はＢピクチャ）ごとに閾値を設定する閾値設定手段をを含むことを特徴とする請求項１記載のビデオ符号化装置。

【請求項３】　前記スキップ手段は、ピクチャタイプがＢピクチャの場合には、スライス層の最初と最後を除いた残りのすべてのマクロブロックがスキップドマクロブロックで構成されるＢピクチャであるオールスキップＢピクチャをプロキシコードとして用い、
ピクチャタイプがＩ又はＰピクチャの場合には、スライス層の最初と最後を除いた残りのすべてのマクロブロックがスキップドマクロブロックで構成されるＰピクチャであるオールスキップＰピクチャをプロキシコードとして用いることを特徴とする請求項２記載のビデオ符号化装置。

【請求項４】　前記閾値設定手段の閾値は、予測符号量＊

＊であることを特徴とする請求項３記載のビデオ符号化装置。

【請求項５】　前記閾値設定手段は、１画像データごとに、画素値の分散値を算出し、当該分散値が大きいほど、より大きな閾値を設定することを特徴とする請求項３記載のビデオ符号化装置。

【請求項６】　前記閾値設定手段は、マクロブロックｊ内に含まれる８ブロック（フレームＤＣＴモードにおける４ブロックとフィールドＤＣＴモードにおける４ブロック）の各ブロックにおける画像データの画素値の分散値のうちの最小値をVAR_jとし、マクロブロックｊのアクティビティをact_jとし、$act_j=1+VAR_j$とし、画像データのアクティビティＡＣＴをすべてのマクロブロックのアクティビティの総和としたときに、
画像データのアクティビティＡＣＴが大きな画像ほど、より大きな閾値を設定することを特徴とする請求項３記載のビデオ符号化装置。

【請求項７】　前記閾値設定手段は、Ｉ又はＰピクチャについては、それぞれの予測符号量を閾値に設定し、Ｂピクチャについては、Ｂピクチャの予測符号量よりも大きな値を閾値に設定することを特徴とする請求項３記載のビデオ符号化装置。

【請求項８】　前記閾値設定手段は、Ｍ（Ｉ又はＰピクチャの出現周期）≧２の場合に、
Ｉピクチャの予測符号量をＥｉ、
Ｐピクチャの予測符号量をＥｐ、
Ｂピクチャの予測符号量をＥｂ、
１ピクチャの復号時間間隔当りの伝送ビット量をＲとしたときに、
Ｉピクチャの閾値Ｔｉ＝Ｅｉ、
Ｐピクチャの閾値Ｔｐ＝Ｅｐ、
符号化順序がＩピクチャの直前のＢピクチャの閾値をＴｂ（ｉ）とすると、

$Tb(i)=Eb+(Ei-R)$　$(Ei-R)\geq 0$のとき、
$Tb(i)=Eb$　$(Ei-R)<0$のとき、

符号化順序がＰピクチャの直前のＢピクチャの閾値をＴ※
※ｂ（ｐ）とすると、

$Tb(p)=Eb+(Ep-R)$　$(Ep-R)\geq 0$のとき、
$Tb(p)=Eb$　$(Ep-R)<0$のとき、

とすることを特徴とする請求項７記載のビデオ符号化装置。

【請求項９】　前記閾値設定手段は、Ｍ（Ｉ又はＰピクチャの出現周期）≧３の場合に、
Ｉピクチャの予測符号量をＥｉ、
Ｐピクチャの予測符号量をＥｐ、
Ｂピクチャの予測符号量をＥｂ、★
★１ピクチャの復号時間間隔当りの伝送ビット量をＲとしたときに、
Ｉピクチャの閾値Ｔｉ＝Ｅｉ、
Ｐピクチャの閾値Ｔｐ＝Ｅｐ、
符号化順序がＩピクチャの直前のＢピクチャ（Ｂ２（ｉ））の閾値をＴｂ２（
ｉ）とすると、

$Tb2(i)=Eb+(Ei-R)$　$(Ei-R)\geq 0$のとき、
$Tb2(i)=Eb$　$(Ei-R)<0$のとき、

符号化順序がＢ２（ｉ）直前のＢピクチャ（Ｂ１☆
☆（ｉ））の閾値をＴｂ１（ｉ）とすると、

$Tb1(i)=Eb+(Tb2(i)-R)$　$(Tb2(i)-R)\geq 0$のとき、

$Tb1(i)=Eb$　$(Tb2(i)-R)<0$ のとき、

符号化順序がＰピクチャ直前のＢピクチャ（Ｂ２（ｐ））の閾値をＴｂ２（ｐ）とすると、

$Tb2(p)=Eb+(Ep-R)$　$(Ep-R)\geqq 0$ のとき、

$Tb2(p)=Eb$　$(Ep-R)<0$ のとき、

符号化順序がＢ２（ｐ）直前のＢピクチャ（Ｂ１（ｐ））の閾値をＴｂ１（ｐ）とすると、

$Tb1(p)=Eb+(Tb2(p)-R)$　$(Tb2(p)-R)\geqq 0$ のとき、

$Tb1(p)=Eb$　$(Tb2(p)-R)<0$ のとき、

とすることを特徴とする請求項７記載のビデオ符号化装置。

【請求項１０】　前記閾値設定手段は、Ｍ（Ｉ又はＰピクチャの出現周期）≧３のときに、符号化順序がＩピクチャの直前のＢピクチャ（Ｂ２）の閾値を、符号化順序が当該Ｂピクチャ（Ｂ２）の直前のＢピクチャ（Ｂ１）の閾値よりも高く設定することを特徴とする請求項７記載のビデオ符号化装置。

【請求項１１】　前記閾値設定手段は、Ｍ（Ｉ又はＰピクチャの出現周期）≧３の場合に、Ｉピクチャの予測符号量をＥｉ、Ｐピクチャの予測符号量をＥｐ、Ｂピクチャの予測符号量をＥｂ、１ピクチャの復号時間間隔当りの伝送ビット量Ｒ、オールスキップＢピクチャの符号量をＤｂｓｋｉｐとしたときに、

Ｉピクチャの閾値Ｔｉ＝Ｅｉ、

Ｐピクチャの閾値Ｔｐ＝Ｅｐ、

符号化順序がＩピクチャの直前のＢピクチャ（Ｂ２（ｉ））の閾値をＴｂ２（ｉ）とすると、

$Tb2(i)=Eb+(Ei-R)$　$(Ei-R)\geqq 0$ のとき、

$Tb2(i)=Eb$　$(Ei-R)<0$ のとき、

符号化順序がＢ２（ｉ）直前のＢピクチャ（Ｂ１（ｉ））の閾値をＴｂ１（ｉ）とすると、

$Tb1(i)=Dbskip+(Tb2(i)-R)$

$Dbskip+(Tb2(i)-R)\geqq Eb$ のとき、

$Tb1(i)=Eb$

$Dbskip+(Tb2(i)-R)<Eb$ のとき

符号化順序がＰピクチャ直前のＢピクチャ（Ｂ２（ｐ））の閾値をＴｂ２（ｐ）とすると、

$Tb2(p)=Eb+(Ep-R)$　$(Ep-R)\geqq 0$ のとき、

$Tb2(p)=Eb$　$(Ep-R)<0$ のとき、

符号化順序がＢ２（ｐ）直前のＢピクチャ（Ｂ１（ｐ））の閾値をＴｂ１（ｐ）とすると、

$Tb1(p)=Dbskip+(Tb2(p)-R)$

$Dbskip+(Tb2(p)-R)\geqq Eb$ のとき、

$Tb1(p)=Eb$

$Dbskip+(Tb2(p)-R)<Eb$ のとき、

とすることを特徴とする請求項１０記載のビデオ符号化装置。

【請求項１２】　復号化装置における受信バッファの蓄積量を予測しながら、１フレーム又は１フィールドの画像データを符号化するビデオ符号化装置であって、

画像データの符号化後において、ピクチャタイプに応じて、Ｍ（Ｉ又はＰピクチャの出現周期）≧２の場合に、

画像データがＩピクチャに符号化された場合の閾値Ｔｉは、当該Ｉピクチャの符号量をＤｉとすると、Ｔｉ＝Ｄｉに設定し、

画像データがＰピクチャに符号化された場合の閾値Ｔｉは、当該Ｐピクチャの符号量をＤｐとすると、Ｔｐ＝Ｄｐに設定し、

符号化順序がＩピクチャ直前のＢピクチャに画像データが符号化された場合の閾値Ｔｂ（ｉ）は、そのＢピクチャの符号量をＤｂとし、Ｉピクチャの予測符号量をＥｉとし、１ピクチャの復号時間間隔当りの伝送ビット量をＲとすると、

$Tb(i)=Db+(Ei-R)$　$(Ei-R)\geqq 0$ のとき、

$Tb(i)=Db$　$(Ei-R)<0$ のとき、

に設定し、

符号化順序がＰピクチャ直前のＢピクチャに画像データが符号化された場合の閾値Ｔｂ（ｐ）は、そのＢピクチャの符号量をＤｂとし、Ｐピクチャの予測符号量をＥｐとし、１ピクチャの復号時間間隔当りの伝送ビット量をＲとすると、

$Tb(p)=Db+(Ep-R)$　$(Ep-R)\geqq 0$ のとき、

$Tb(p)=Db$　$(Ep-R)<0$ のとき、

に設定する閾値設定手段と、

画像データの符号後において、その画像データの符号化データの復号化時刻において受信バッファに蓄積されているであろうと予測蓄積量と、前記設定された閾値とを比較する比較手段と、

予測蓄積量が閾値未満の場合には、前記復号化時刻に受信バッファから取出される前記画像データの符号化データの代わりに、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを用いるスキップ手段と、

を備えたことを特徴とするビデオ符号化装置。

【請求項１３】　１フレームの画像データをフレーム構

造で符号化するビデオ符号化装置であって、
画像データを符号化する際に、出力バッファの蓄積量又は復号化装置の受信バッファの予測蓄積量と所定の基準値とを比較する比較手段と、
前記蓄積量又は予測蓄積量が所定の基準値に達したと判定された場合に、前記画像データのフレーム構造での符号化を中止し、前記画像データのトップフィールド及びボトムフィールドの符号化データの代わりに、過去に復号化された画像データを構成するトップフィールド又はボトムフィールドと同一である２つのフィールドを表示すべき旨を定めたプロキシコードを用いるスキップ手段とを備えたことを特徴とするビデオ符号化装置。
【請求項１４】　前記スキップ手段は、過去に復号化された画像データを構成するトップフィールド又及びボトムフィールドのうち、前記フレーム構造での符号化を中止した画像データの各フィールドに表示順序が最も近いフィールドと同一である２つのフィールドを表示すべき旨を定めたプロキシコードを用いることを特徴とする請求項１３記載のビデオ符号化装置。
【請求項１５】　前記スキップ手段は、フレーム構造での符号化を中止した前記画像データが符号化される予定であったピクチャのタイプがＢピクチャの場合には、スライス層の最初と最後を除いた残りのすべてのマクロブロックがスキップドマクロブロックで構成されるＢピクチャであるオールスキップＢピクチャの２つを前記プロキシコードとしフレーム構造での符号化を中止した前記画像データが符号化される予定であったピクチャのタイプがＩ又はＰピクチャの場合には、スライス層の最初と最後を除いた残りのすべてのマクロブロックがスキップドマクロブロックで構成されるＰピクチャであるオールスキップＰピクチャの２つを前記プロキシコードとすることを特徴とする請求項１４記載のビデオ符号化装置。
【請求項１６】　前記スキップ手段は、フレーム構造での符号化を中止した前記画像データが符号化される予定であったピクチャのタイプがＩ又はＰピクチャの場合において用いる前記オールスキップＰピクチャでは、表示順序が先となるＩ又はＰピクチャの画像データのボトムフィールドを参照フィールドとし、
フレーム構造での符号化を中止した前記画像データが符号化される予定であったピクチャのタイプがＩ又はＰピクチャの直後に符号化されるＢピクチャ（Ｂ１）の場合において用いる前記オールスキップＢピクチャでは、表示順序が先となるＩ又はＰピクチャの画像データのボトムフィールドを参照フィールドとし、
フレーム構造での符号化を中止した前記画像データが符号化される予定であったピクチャのタイプがＩ又はＰピクチャの直前に符号化されるＢピクチャ（Ｂ２）の場合において用いる前記オールスキップＢピクチャでは、表示順序が後となるＩ又はＰピクチャの画像データのトップフィールドを参照フィールドとすることを特徴とする請求項１５記載のビデオ符号化装置。
【請求項１７】　前記スキップ手段は、フレーム構造での符号化を中止した前記画像データが符号化される予定であったピクチャのタイプがＩ又はＰピクチャの場合には、その後にＢピクチャに符号化される画像データの符号化を中止し、当該画像データのトップフィールド及びボトムフィールドの符号化データの代わりに、表示順序が先のボトムフィールドを参照フィールドとしたオールスキップＢピクチャの２つを用いることを特徴とする請求項１７記載のビデオ符号化装置。
【請求項１８】　復号化装置における受信バッファの蓄積量を予測しながら、１フレーム又は１フィールドの画像データを符号化するビデオ符号化装置であって、
画像データを符号化する前に、当該画像データの符号化データの復号化時刻において受信バッファに蓄積されているであろうと予測される予測蓄積量と、画像データが符号化されるピクチャタイプごとの閾値とを比較する比較手段と、
予測蓄積量が閾値未満の場合であって、前記画像データが符号化されるピクチャのタイプがＢピクチャの場合には、前記画像データの符号化を中止し、前記復号化時刻に受信バッファから取出される前記画像データの符号化データの代わりに、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを用いる制御手段とを備えたことを特徴とするビデオ符号化装置。
【請求項１９】　復号化装置における受信バッファの蓄積量を予測しながら、１フレーム又は１フィールドの画像データを符号化するビデオ符号化装置であって、
画像データを符号化する前に、当該画像データの符号化データの復号化時刻において受信バッファに蓄積されているであろうと予測される予測蓄積量と、画像データが符号化されるピクチャタイプごとの閾値とを比較する比較手段と、
予測蓄積量が閾値未満の場合であって、前記画像データが符号化されるピクチャのタイプがＢ又はＰピクチャの場合には、前記画像データの符号化を中止し、前記復号化時刻に受信バッファから取出される前記画像データの符号化データの代わりに、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを用いる制御手段とを備えたことを特徴とするビデオ符号化装置。
【請求項２０】　復号化装置における受信バッファの蓄積量を予測しながら、１フレーム又は１フィールドの画像データを符号化するビデオ符号化方法であって、
画像データを符号化する前に、当該画像データの符号化データの復号化時刻において受信バッファに蓄積されているであろうと予測される予測蓄積量と、所定の閾値とを比較するステップと、
予測蓄積量が閾値未満の場合には、前記画像データの符

号化を中止し、前記復号化時刻に受信バッファから取出されるデータとして、前記画像データの符号化データの代わりに、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを用いるステップとを含むことを特徴とするビデオ符号化方法。

【請求項２１】　１フレームの画像データをフレーム構造で符号化するビデオ符号化方法であって、

画像データを符号化する際に、出力バッファの蓄積量又は復号化装置の受信バッファの予測蓄積量と所定の基準値とを比較するステップと、

前記蓄積量又は予測蓄積量が所定の基準値に達したと判定された場合に、前記画像データのフレーム構造での符号化を中止し、前記画像データのトップフィールド及びボトムフィールドの符号化データの代わりに、過去に復号化された画像データを構成するトップフィールド又はボトムフィールドと同一である２つのフィールドを表示すべき旨を定めたプロキシコードを用いるステップとを含むことを特徴とするビデオ符号化方法。

【請求項２２】　復号化装置における受信バッファの蓄積量を予測しながら、１フレーム又は１フィールドの画像データを符号化するためにコンピュータを、

画像データを符号化する前に、当該画像データの符号化データの復号化時刻において受信バッファに蓄積されているであろうと予測される予測蓄積量と、所定の閾値とを比較する比較手段と、

予測蓄積量が閾値未満の場合には、前記画像データの符号化を中止し、前記復号化時刻に受信バッファから取出されるデータとして、前記画像データの符号化データの代わりに、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを用いるスキップ手段として機能させるためのビデオ符号化プログラム。

【請求項２３】　１フレームの画像データをフレーム構造で符号化するためにコンピュータを、

画像データを符号化する際に、出力バッファの蓄積量又は復号化装置の受信バッファの予測蓄積量と所定の基準値とを比較する比較手段と、

前記蓄積量又は予測蓄積量が所定の基準値に達したと判定された場合に、前記画像データのフレーム構造での符号化を中止し、前記画像データのトップフィールド及びボトムフィールドの符号化データの代わりに、過去に復号化された画像データを構成するトップフィールド又はボトムフィールドと同一である２つのフィールドを表示すべき旨を定めたプロキシコードを用いるスキップ手段とととして機能させるためのビデオ符号化プログラム。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、ビデオ符号化装置に関し、特に、画像データの符号化をスキップして符号量を調整するビデオ符号化装置に関する。

【０００２】

【従来の技術】ＭＰＥＧ規格に基づくビデオ符号化では、復号化装置の受信バッファのピクチャの蓄積量を予測しながら、符号量の制御を行っている。これをＶＢＶ（Ｖｉｄｅｏ　Ｂｕｆｆｅｒｉｎｇ　Ｖｅｒｉｆｉｅｒ）モデルによる符号量制御という。

【０００３】図２０（ａ）は、受信バッファの予測蓄積量の通常時の遷移を示す。同図に示すように、受信バッファには、一定のレートでピクチャが入力される。そして、ＤＴＳ（Ｄｅｃｏｄｉｎｇ　Ｔｉｍｅ　Ｓｔａｍｐ）で示される時刻に、１ピクチャが復号化のため受信バッファから出力される。復号化装置がＮＴＳＣ方式の表示部を有する場合、ＤＴＳは、１フレームを１ピクチャに割り当てた場合には、１／３０秒ごとに、１フィールドを１ピクチャに割り当てた場合には、１／６０秒ごとに設定される。また、復号化装置がＰＡＬ方式の表示部を有する場合、ＤＴＳは、１フレームを１ピクチャに割り当てた場合には、１／２５秒ごとに、１フィールドを１ピクチャに割り当てた場合には、１／５０秒ごとに設定される。

【０００４】通常時は、図２０（ａ）に示すように、ＤＴＳ１で復号化されるピクチャのビット発生量がＤ１であるとすると、ＤＴＳ１では、受信バッファの予測蓄積量は、Ｖ１からＶ１'（＝Ｖ１－Ｄ１）に減少する。ＶｂＶモデルでは、受信バッファの予測蓄積量がオーバーフローやアンダーフローを引き起こさないように符号量が制御される。

【０００５】シーンチェンジなどの時点では、図２０（ｂ）のように、ビット発生量の大きいピクチャが連続することにより、受信バッファがアンダーフローすることがある。すなわち、ＤＴＳ３で復号化されるピクチャのビット発生量がＤ３であるとすると、ＤＴＳ３では、Ｖ３－Ｄ３＜０より、受信バッファの予測蓄積量が０未満となる。これは、ＤＴＳ３で復号化されるピクチャが、まだ受信バッファに入力されていないことによる。このような場合には、量子化スケールを大きくしてビット発生量を減少させることによりアンダーフローを回避するようにしている。

【０００６】また、図２０（ｃ）に示すように、ビット発生量の小さいピクチャが連続することにより、受信バッファがオーバーフローすることがある。すなわち、受信バッファの予測蓄積量がＤＴＳ３の復号化前では、Ｖ３（＝Ｖ２'＋Ｒ、ＲはＤＴＳ間隔（１ピクチャの復号時間間隔）ごとに復号化装置の受信バッファに入力されるビット量、言い換えると、ＤＴＳ間隔ごとに符号化装置からの伝送されるビット量）となり、Ｖ３は、受信バッファ容量を超えている。このような場合には、量子化スケールを小さくしてビット発生量を増大させることによりオーバーフローを回避するようにしている。

【０００７】しかしながら、上述のようにアンダーフロ

ーを防止するために量子化スケールを大きくしてビット発生量を極度に減少させた場合には、画質の劣化が生じてしまう。そのため、従来から量子化スケールの調整とともに、以下の方法が併用されている。第１の方法は、いわゆるスキップドマクロブロックを用いる方法である。ＭＰＥＧでは、１６×１６の画素ブロックであるマクロブロック単位で符号化処理が行われる。スキップドマクロブロックとは、その位置では、参照画像と同一の画像を表示すべき旨を定めた特別なコードからなるマクロブロックであり、データ量が極めて小さい。従って、アンダーフローしそうな場合には、本来の画像の符号化を行わずに、スキップドマクロブロックを送出するようにすればよい。

【０００８】しかし、この方法では、スキップドマクロブロックでないマクロブロックの位置では、本来の画像の部分が表示され、スキップドマクロブロックの位置では、参照している画像の部分が表示されることになり、全体として整合しない画像となる。図２１（ａ）は、通常時に表示される画面の例を示す。

【０００９】図２１（ｂ）は、スキップドマクロブロックを用いた場合に表示される画面の例を示す。第２フレームでは、上半分のマクロブロックはスキップドマクロブロックでないマクロブロックが用いられたため本来の第２フレームの画像部分が表示され、下半分のマクロブロックはスキップドマクロブロックが用いられたために、第１フレームの画像部分が表示され、全体として整合しない画像となる。

【００１０】第２の方法は、擬似画像データを符号化する方法である。擬似画像データとは、その画素値が取り得る範囲の中の中央値である画像データである。例えば、画素値を８ビットで表わす場合には、中央値は１２８となる。ＭＰＥＧでは、画像データの画素値と中央値との差分値が符号化されるので、画像値が中央値である画像データの符号化データのデータ量は最小である。従って、マクロブロックごとに、アンダーフローが起こりそうな場合には、本来の符号化を行わずに、画素値が中央値の画像データを符号化すればよい。

【００１１】しかし、この方法では、画素値を中央値とした位置では、グレー色の画像が表示される。図２１（ｃ）は、擬似画像を用いたときに表示される画面の例を示す。第２フレームでは、上半部のマクロブロックは、本来の画像符号化されたため、本来の第２フレームの画像部分が表示され、下半分のマクロブロックは、擬似画像データを符号化したため、グレー色の画像が表示され、全体として整合しない画像となる。

【００１２】ところで、特許２８７１３１６号には１フィールド又は１フレームの画像データ全体の符号化をスキップ（以下、ピクチャをスキップするという。）する方法が記載されている。図２２は、特許２８７１３１６号に記載されたビデオ符号化装置の構成を示す。このビデオ符号装置の概略を説明すると、入力された動画像データに対して、直交変換回路６等により符号化処理が行われ、バッファメモリ２１にピクチャが蓄えられる。伝送レート超過判定回路２４で伝送レートが一定値を超過していると判定された場合には、ＳＫＩＰコード格納メモリ２２内のＳＫＩＰコードが出力され、伝送レートが超過していないと判定された場合には、バッファメモリ２０内のピクチャが出力される。

【００１３】以上のように、この方法によれば、スキップする際には、ピクチャの一部のマクロブロックのみスキップドマクロブロックとするのでなく、ピクチャ内のスライス層の最初と最後を除いた残りのすべてのマクロブロックをスキップドマクロブロックとする。これにより、復号化装置では、過去に復号化された画像の全体と同一の画像が表示され、上述のような不整合な画像は表示されないことになる。

【００１４】

【発明が解決しようとする課題】しかしながら、上述の特許公報に記載された方法には、以下の問題がある。第１の問題は、発生したピクチャ量が伝送レートを超過しているか否かを判定するために、図２２に示すような、生成したピクチャを一時的に蓄えておくバッファメモリ２０が必要となることである。すなわち、上述のように、マクロブロックごとにスキップするか否かを判定する場合には、マクロブロック単位の符号化データを蓄積するための小容量のバッファを備えればよかったが、この方法では、ピクチャ全体でスキップするか否かを判定するので、ピクチャ内のすべてのマクロブロックの符号量を蓄えておくための大容量のバッファ容量が必要となる。

【００１５】第２の問題は、１フレームを１ピクチャに割り当てている（フレーム構造）場合に、ピクチャをスキップした場合には、インタレース走査方式で表示すると、表示順序が逆転する場合があることである。図２３（ａ）は、ピクチャをスキップしない通常時の表示画面を示す。１ｔ、１ｂは、それぞれ、第１フレームのトップフィールド、ボトムフィールドを表わす。フレーム構造では、トップフィールドとボトムフィールドを併せた１フレームを単位として符号化処理がなされる。この場合、復号化装置では、１／３０秒ごとに、１フレームを単位として復号化処理がなされる。インタレース方式で表示するので、１／６０秒ごとに、フレーム内の各フィールドが表示される。すなわち、１ｔ、１ｂ、２ｔ、２ｂ、３ｔ、３ｂ、４ｔ、４ｂの順序で表示される。

【００１６】図２３（ｂ）は、ピクチャのスキップが発生した場合の表示画面を示す。Ｂ（３）において、スキップが発生した場合、Ｂ（３）に符号化されたフレーム２では、Ｂ（３）が参照しているＩ（１）と同一の画像が表示される。従って、フレーム２のトップフィールドは、フレーム１のトップフィールドである１ｔと同じに

なり、フレーム２のボトムフィールドは、フレーム１のボトムフィールドである１ｂと同じになる。そして、インタレース方式で表示するために、１／６０秒ごとに、１ｔ、１ｂ、１ｔ、１ｂ、３ｔ、３ｂ、４ｔ、４ｂの順序で表示される。これにより、１ｂの後に１ｔが表示され、表示順序が逆転してしまう。

【００１７】そこで、本発明は、ピクチャ全体をスキップするか否かを判定するための特別のバッファを不要とするとともに、ピクチャ全体をスキップしたときでも、表示順序が逆転しないビデオ符号化装置を提供することを目的とする。

【００１８】

【課題を解決するための手段】上記目的を達成するために、本発明は、復号化装置における受信バッファの蓄積量を予測しながら、１フレーム又は１フィールドの画像データを符号化するビデオ符号化装置であって、画像データを符号化する前に、当該画像データの符号化データの復号化時刻において受信バッファに蓄積されているであろうと予測される予測蓄積量と、所定の閾値とを比較する比較手段と、予測蓄積量が閾値未満の場合には、前記画像データの符号化を中止し、前記復号化時刻に受信バッファから取出されるデータとして、前記画像データの符号化データの代わりに、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを用いるスキップ手段とを備えたことを特徴とする。

【００１９】また、本発明は、１フレームの画像データをフレーム構造で符号化するビデオ符号化装置であって、画像データを符号化する際に、出力バッファの蓄積量又は復号化装置の受信バッファの予測蓄積量と所定の基準値とを比較する比較手段と、前記蓄積量又は予測蓄積量が所定の基準値に達したと判定された場合に、前記画像データのフレーム構造での符号化を中止し、前記画像データのトップフィールド及びボトムフィールドの符号化データの代わりに、過去に復号化された画像データを構成するトップフィールド又はボトムフィールドと同一である２つのフィールドを表示すべき旨を定めたプロキシコードを用いるスキップ手段とを備えたことを特徴とする。

【００２０】

【発明の実施の形態】以下、本発明の実施の形態について図面を用いて説明する。

<第１の実施形態>本実施の形態は、ピクチャを生成する前に、ピクチャタイプごとの経験値に基づく予測符号量が受信バッファの予測蓄積量を超えているか否かでピクチャをスキップするか否かを判定するビデオ符号化装置に関する。

（ビデオ符号化装置の構成）図１は、本実施の形態に係るビデオ符号化装置１００の構成を示す。ビデオ符号化装置１００は、画面並び替え手段１１０と、ＤＣＴ手段

１１３と、量子化手段１１４と、レート制御手段１１５と、可変長符号化手段１１６と、バッファ１１７と、逆量子化手段１１９と、逆ＤＣＴ手段１２０と、ビデオメモリ１２２と、動き補償予測手段１２３と、加算器１１１、１１２と、切替え器１１８と、受信バッファ蓄積量予測手段１２４と、比較判定手段１２５と、ＳＫＩＰピクチャ格納メモリ１２６と、閾値設定手段１２７とから構成される。

【００２１】画面並び替え手段１１０は、ピクチャタイプに合わせて画面を符号化する順序に並び替える。図２（ａ）は、ビデオ画像のもともとの順序、従って、復号化装置で表示される順序を示す。図２（ｂ）は、符号化順序、従って、復号化装置に入力される順序を示す。Ｂピクチャは、時間的に前後のＩ又はＰピクチャの画像を用いて符号化を行うため、未来のＰピクチャを符号化した後で、符号化される。

【００２２】ＤＣＴ手段１１３は、マクロブロック単位で離散コサイン変換（ＤＣＴ）演算を行い、ＤＣＴ係数を出力する。ここで、Ｉ（Ｉｎｔｒａ　ｃｏｄｅｄ）ピクチャについては、イントラ符号化モードでＤＣＴ演算を行い、Ｐ（Ｐｒｅｄｉｃｔｉｖｅ　ｃｏｄｅｄ）ピクチャとＢ（Ｂｉｄｉｒｅｃｔｉｏｎａｌｌｙ　ｐｒｅｄｉｃｔｉｖｅ　ｃｏｄｅｄ）ピクチャについては、マクロブロック単位でイントラ符号化モード又は動き補償予測モードを選択してＤＣＴ演算を行う。イントラ符号化モードの場合には、入力された原画像をそのままＤＣＴ演算する。動き補償予測モードの場合には、原画像と動き補償予測手段１２３によって得られる予測画像との差分をＤＣＴ演算する。

【００２３】量子化手段１１４は、マクロブロック毎に量子化スケールを変更させて、ＤＣＴ係数の量子化を行う。可変長符号化手段１１６は、量子化されたＤＣＴ係数を、動きベクトル、符号化予測モード情報とともに可変長符号化して画像データの符号化データを生成する。

【００２４】バッファ１１７は、可変長符号化された画像データの符号化データ又はオールスキップピクチャを格納する。逆量子化手段１１９と、逆ＤＣＴ手段１２０は、Ｉ又はＰピクチャの復号化画像については、動き補償予測の参照画像として用いる必要があるため、量子化されたＤＣＴ係数から、逆量子化、逆ＤＣＴを行って得られる復号化画像を復元してビデオメモリ１２２に出力する。

【００２５】ビデオメモリ１２２は、Ｉ又はＰピクチャの復号化画像を参照画像として格納する。動き補償予測手段１２３は、Ｐ又はＢピクチャの符号化のために、ビデオメモリ１２２に格納された参照画像から動きベクトルを用いて予測画像を出力する。レート制御手段１５は、受信バッファの予測蓄積量に応じて、量子化手段１１４に対して量子化スケールの変更を指示する。すなわち、レート制御手段１１５は、受信バッファの予測蓄積

量が一定量以上になれば量子化スケールを小さくするように、一定量以下となれば量子化スケールを大きくするように量子化手段１１４に指示する。

【００２６】ＳＫＩＰピクチャ格納メモリ１２６は、Ｐピクチャ用とＢピクチャ用のオールスキップピクチャを格納する。ここで、オールスキップピクチャとは、１ピクチャ内のスライス層の最初と最後を除いた残りのすべてのマクロブロックがスキップドマクロブロックで構成されるようなピクチャをいう。Ｂピクチャ、Ｐピクチャの代わりには、それぞれ、スライス層の最初と最後を除いた残りのすべてのマクロブロックがスキップドマクロブロックからなるＢピクチャ、Ｐピクチャ（これらをそれぞれオールスキップＢピクチャ、オールスキップＰピクチャと呼ぶ。）が送出される。Ｉピクチャは、スキップすることができない（マクロブロックをスキップドマクロブロックにできない。）ので、Ｉピクチャの代わりには、オールスキップＰピクチャが送出される。これらのオールスキップピクチャは、画像データの符号化データの代わりに送出するもので、画像データの符号化データのいわばプロキシコードである。

【００２７】受信バッファ蓄積量予測手段１２４は、１ピクチャを出力するごとに、次のピクチャの復号化時刻における復号前の受信バッファの予測蓄積量を算出する。図３（ａ）は、ピクチャをスキップしない通常時の受信バッファの予測蓄積量を示す。ＤＴＳｎの時点での復号前の受信バッファの予測蓄積量をＶＢＶ（ｎ）とし、ＤＴＳｎの時点で復号化されるＢピクチャのビット発生量をＤｂとし、ＤＴＳ間隔ごとの伝送ビット量をＲとすると、ＶＢＶ（ｎ＋１）＝ＶＢＶ（ｎ）－Ｄｂ＋Ｒが算出される。

【００２８】図３（ｂ）は、ピクチャをスキップしたときの受信バッファの予測蓄積量を示す。ＤＴＳｎの時点での復号前の受信バッファの予測蓄積量をＶＢＶ（ｎ）とし、ＤＴＳｎの時点で復号化されるオールスキップＢピクチャのビット発生量をＤｂｓｋｉｐとし、ＤＴＳ間隔ごとの符号化装置から伝送されるビット量をＲとすると、ＶＢＶ（ｎ＋１）＝ＶＢＶ（ｎ）－Ｄｂｓｋｉｐ＋Ｒが算出される。

【００２９】閾値設定手段１２７は、ピクチャタイプ（Ｉ、Ｐ、Ｂ１、Ｂ２ピクチャ）ごとに、それぞれ閾値（Ｔｉ、Ｔｐ、Ｔｂ１、Ｔｂ２）を設定する。図４は、閾値の設定例を示す。次式のように、ピクチャタイプごとに経験的に知られている符号量（予測符号量）Ｅｉ、Ｅｐ、Ｅｂが、それぞれ閾値Ｔｉ、Ｔｐ、Ｔｂ１、Ｔｂ２に設定される。

Ｔｉ＝Ｅｉ

Ｔｐ＝Ｅｐ

Ｔｂ１＝Ｅｂ

Ｔｂ２＝Ｅｂ

本実施の形態では、画像データの解像度が７２０画素×４８０画素の場合の最適な値として経験的に知られている、Ｅｉ＝４００ｋｂｉｔ、Ｅｐ＝２００ｋｂｉｔ、Ｅｂ＝１６０ｋｂｉｔを用いるものとする。また、画像データの解像度と、予測符号量はほぼ比例関係を有するので、解像度が上記と異なる場合でも、解像度に比例して予測符号量を算出すればよい。

【００３０】比較判定手段１２５は、１つの画像データごとに、その画像データが符号化される前に受信バッファの予測蓄積量ＶＢＶと閾値の大きさとを比較して、画像の符号化処理をスキップするか否かを判定する。すなわち、比較判定手段１２５は、その画像をＩピクチャとして符号化する場合にはＶＢＶ＜Ｔｉならスキップすると判定し、その画像をＰピクチャとして符号化する場合にはＶＢＶ＜Ｔｐならスキップすると判定し、その画像をＢ１ピクチャとして符号化する場合にはＶＢＶ＜Ｔｂ１ならスキップすると判定し、その画像をＢ２ピクチャとして符号化する場合にはＶＢＶ＜Ｔｂ２ならスキップすると判定する。

【００３１】図５は、ピクチャがスキップされる場合の例を示す。図５（ａ）では、ＶＢＶ＜Ｔｉにより、ＤＴＳｎにおいてＩピクチャをスキップする。図５（ｂ）では、ＶＢＶ＜Ｔｂ１により、ＤＴＳｎ＋１においてＢ１ピクチャをスキップする。

【００３２】図５（ｃ）では、ＶＢＶ＜Ｔｂ２により、ＤＴＳｎ＋２においてＢ２ピクチャをスキップする。図５（ｄ）では、ＶＢＶ＜Ｔｐにより、ＤＴＳｎ＋３においてＰピクチャをスキップする。比較判定手段１２５は、ピクチャをスキップすると判定した場合には、ＤＣＴ手段１１３に対して符号化処理を中止させるとともに、ＳＫＩＰピクチャ格納メモリ１２６からピクチャタイプに応じたオールスキップピクチャを出力させる。

【００３３】図６（ａ）は、復号化装置で通常表示される画面の例を示す。第１、第２、第３、第４フレームで、それぞれ、Ｉ（１）、Ｂ（３）、Ｂ（４）、Ｐ（２）の復号化画像が表示される。（）内の数字は符号化する順序を示す。図６（ｂ）は、ピクチャをスキップしたときに復号化装置で表示される画面の例を示す。第２フレームのＢ（３）ピクチャをスキップしたときに、Ｂ（３）は、Ｉ（１）とＰ（２）の復号化画像を参照画像としているが、第２フレームでは、より表示順序が近いＩ（１）の復号化画像が表示される。

（動作）次に、本実施の形態に係るビデオ符号化装置のスキップ処理に関連する動作について説明する。

【００３４】図７は、ビデオ符号化装置の動作手順を示すフロチャートである。まず、閾値設定手段１２７が、ピクチャタイプごとにスキップ判定のための閾値Ｔｉ、Ｔｐ、Ｔｂ１、Ｔｂ２を設定する（ステップＳ５０１）。次に、原画像をＩピクチャとして符号化する際には、比較判定手段１２５が、受信バッファの予測蓄積量ＶＢＶと閾値Ｔｉとの大きさを比較判定する。ＶＢＶ≧

Ｔｉの場合には、ＤＣＴ手段１１３、量子化手段１１４及び可変長符号化手段１１６により原画像がＩピクチャとして符号化処理が行われる（ステップＳ５０２、Ｓ５０３、Ｓ５０４）。

【００３５】そして、受信バッファ蓄積量予測手段１２４が、生成したＩピクチャのビット発生量とＤＴＳ時間間隔ごとの伝送ビット量Ｒとにより、次のＤＴＳ時点での復号化前の受信バッファの予測蓄積量ＶＢＶを算出する（ステップＳ５０５）。そして、次の画像データがある場合には、処理を続行し、次の画像データがないなら処理を終了する（ステップＳ５０６）。

【００３６】一方、ステップＳ５０３において、比較判定手段１２５が、ＶＢＶ＜Ｔｉと判定した場合には、比較判定手段１２５は、さらに、ＶＢＶとＴｐとの大きさを比較する。ＶＢＶ≧Ｔｐの場合には、原画像がＰピクチャとして符号化処理がなされ、ＶＢＶ＜Ｔｐの場合には、ＳＫＩＰピクチャ格納メモリ１２６から、オールスキップＰピクチャが出力される。そして、受信バッファ蓄積量予測手段１２４が、オールスキップＰピクチャのビット発生量と、ＤＴＳ時間間隔ごとの伝送ビット量Ｒとにより、次のＤＴＳ時点での復号化前の受信バッファの予測蓄積量ＶＢＶを算出する（ステップＳ５０８、Ｓ５０９、Ｓ５１０、Ｓ５０５）。

【００３７】また、原画像をＰピクチャとして符号化する際には、比較判定手段１２５が、受信バッファの予測蓄積量ＶＢＶと閾値Ｔｐとの大きさを比較判定する。ＶＢＶ≧Ｔｐの場合には、通常どおり原画像がＰピクチャとして符号化処理がなされ、ＶＢＶ＜Ｔｐの場合には、ＳＫＩＰピクチャ格納メモリ１２６から、オールスキップＰピクチャが出力される。そして、受信バッファ蓄積量予測手段１２４が、生成したＰピクチャのビット発生量又はオールスキップＰピクチャのビット発生量と、ＤＴＳ時間間隔ごとの伝送ビット量Ｒとにより、次のＤＴＳ時点での復号化前の受信バッファの予測蓄積量ＶＢＶを算出する（ステップＳ５０７、Ｓ５０８、Ｓ５０９、Ｓ５１０、Ｓ５０５）。

【００３８】また、原画像をＢ１ピクチャとして符号化する際には、比較判定手段１２５が、受信バッファの予測蓄積量ＶＢＶと閾値Ｔｂ１との大きさを比較判定する。ＶＢＶ≧Ｔｂ１の場合には、通常どおり原画像がＢピクチャとして符号化処理がなされ、ＶＢＶ＜Ｔｂ１の場合には、ＳＫＩＰピクチャ格納メモリ１２６から、オールスキップＢピクチャが出力される。そして、受信バッファ蓄積量予測手段１２４が、生成したＢピクチャのビット発生量又はオールスキップＢピクチャのビット発生量と、ＤＴＳ時間間隔ごとの伝送ビット量Ｒとにより、次のＤＴＳ時点での復号化前の受信バッファの予測蓄積量ＶＢＶを算出する（ステップＳ５１１、Ｓ５１２、Ｓ５１３、Ｓ５１４、Ｓ５０５）。

【００３９】また、原画像をＢ２ピクチャとして符号化する際には、比較判定手段１２５が、受信バッファの予測蓄積量ＶＢＶと閾値Ｔｂ２との大きさを比較判定する。ＶＢＶ≧Ｔｂ２の場合には、通常どおり原画像がＢピクチャとして符号化処理がなされ、ＶＢＶ＜Ｔｂ２の場合には、ＳＫＩＰピクチャ格納メモリ１２６から、オールスキップＢピクチャが出力される。そして、受信バッファ蓄積量予測手段１２４が、生成したＢピクチャのビット発生量又はオールスキップＢピクチャのビット発生量と、ＤＴＳ時間間隔ごとの伝送ビット量Ｒとにより、次のＤＴＳ時点での復号化前の受信バッファの予測蓄積量ＶＢＶを算出する（ステップＳ５１１、Ｓ５１５、Ｓ５１３、Ｓ５１４、Ｓ５０５）。

（まとめ）以上のように、本実施の形態に係るビデオ符号化装置では、一旦ピクチャを生成してから、そのビット発生量が受信バッファの予測蓄積量を超えているか否かでピクチャをスキップするか否かを判定するのではなく、ピクチャを生成する前に、ピクチャタイプごとの経験値に基づく予測符号量が受信バッファの予測蓄積量を超えているか否かでピクチャをスキップするか否かを判定するので、生成したピクチャをスキップするか否かの判定のために一時的に蓄えておく特別のバッファを不要にすることができる。

【００４０】以上、第１の実施形態について説明したが、本発明は上記の実施形態に限定されないことは勿論である。すなわち、以下のような変形も本発明に含まれるのは勿論である。

（変形例１）本実施の形態では、閾値として固定値を用いたが、原画像ごとに、その複雑性に応じて閾値を決めるようにしてもよい。

【００４１】P_k（ｋ＝１～６４）を８×８画素のブロック内の原画像の画素値とする。ブロック内の平均値$E(P_k)$とすると、$E(P_k)=1/64\times\Sigma P_k$となる。また、分散値を$V(P_k)$とすると、$V(P_k)=1/64\times\Sigma(P_k-E(P_k))^2$となる。

【００４２】マクロブロックｊ内に含まれる８ブロック（フレームＤＣＴモードにおける４ブロックとフィールドＤＣＴモードにおける４ブロック）の$V(P_k)$の最小値をVAR_jとすると、$VAR_j=MIN[V(P_k)]$となる。マクロブロックｊのアクティビティをact_jとすると、$act_j=1+VAR_j$となる。

【００４３】原画像のアクティビティＡＣＴをすべてのマクロブロックのアクティビティの総和とすると、$ACT=\Sigma act_j$となる。アクティビティは、原画像の画素値の分散量を反映したもので、アクティビティが大きいと、原画像のフレーム内での複雑性が高いので、ピクチャのビット発生量が多いと考えられる。従って、アクティビティが大きいほど、閾値を高く設定すればよいと考えることができる。

【００４４】また、分散量に基づいて、閾値を設定するようにしてもよい。例えば、$VAR=\Sigma VAR_j$とし、

ＶＡＲが大きいと、閾値を高く、ＶＡＲが小さいと閾値を低く設定するようにしてもよい。また、分散量として、ブロックごとの分散でなく、画像全体の画素の分散を用いてもよい。すなわち、画像全体の画素数をＮとし、P_l（$l=1$～Ｎ）を原画像の画素値とすると、画像全体の画素の平均値Ｅは、$E=1/N\times\Sigma P_l$となり、画像全体の分散値Ｖは、$V=1/N\times\Sigma(P_l-E(P_l))^2$となる。そして、Ｖが大きいと、閾値を高く、Ｖが小さいと閾値を低く設定するようにしてもよい。

（変形例２）本実施の形態では、ピクチャタイプごとの予測符号量が受信バッファの予測蓄積量を超えている場合には、ピクチャタイプに係らず、ピクチャをスキップするものとした。しかし、ＩピクチャやＰピクチャの復号化画像は、他のピクチャの参照画像として用いられるので、後述するように、ＩピクチャやＰピクチャでのスキップは、他のピクチャにも影響を与える。従って、ピクチャタイプに応じて、ピクチャをスキップするか、又は量子化スケールを大きくしたり、ＤＣＴ後のＤＣ成分のみを用いたり、擬似画像データを符号化したりするような符号量を抑制した符号化を行うかのいずれかを行うものとしてもよい。

【００４５】例えば、予測符号量が受信バッファの予測蓄積量を超えているときには、Ｂピクチャの場合にのみピクチャのスキップを行い、Ｉ又はＰピクチャの場合は符号量を抑制した符号化を行うものとしてもよい。あるいは、Ｂ又はＰピクチャの場合にのみピクチャのスキップを行い、Ｉピクチャの場合は符号量を抑制した符号化を行うものとしてもよい。

（変形例３）本実施の形態では、アンダーフローをおおかた防止できるが、アンダーフローを完全に防止するために、予測符号量が受信バッファの予測蓄積量よりも大きいときには、前述したようにマクロブロック単位で符号化後に、そのマクロブロックの符号量と受信バッファの蓄積量とを比較して、アンダーフローするような場合には、そのマクロブロックをスキップドマクロブロックとするようにしてもよい。

<第２の実施形態>本実施の形態は、Ｐ又はＩピクチャよりも、Ｂピクチャでスキップが起こりやすくしたビデオ符号化装置に関する。

（構成）本実施の形態に係るビデオ符号化装置の構成は、概ね第１の実施形態に係るビデオ符号化装置と共通するが、閾値設定手段１２７による閾値の設定の仕方が異なる。以下、閾値設定手段１２７による閾値の設定方法について説明する。

【００４６】閾値設定手段１２７は、ピクチャタイプ（Ｉ、Ｐ、Ｂ１、Ｂ２ピクチャ）ごとに、それぞれ閾値（Ｔｉ、Ｔｐ、Ｔｂ１、Ｔｂ２）を設定する。図８は、閾値の設定例を示す。次式のように、ＴｉとＴｐは、第１の実施形態と同様に予測符号量Ｅｉ、Ｅｐに設定される。

$Ti=Ei$

$Tp=Ep$

Ｉピクチャ又はＰピクチャでスキップした場合には、スキップしたピクチャを参照しているＢピクチャも、スキップしたピクチャと同一の画面になる。この場合には、例えば、Ｍ（Ｉ又はＰピクチャの出現周期）＝３のときには、４フレームが連続して同一の画面になる。従って、できるだけＰピクチャの直前のＢピクチャでスキップが起こるように、Ｂピクチャの閾値を第１の実施形態よりも大きく設定する。

【００４７】図９は、Ｐピクチャ直前のＢピクチャの閾値を説明する図である。ＤＴＳｎ＋１の時点でのＶＢＶ（ｎ＋１）とすると、ＤＴＳｎ＋２の時点では、$VBV(n+2)=VBV(n+1)-Eb+R$となる。$VBV(n+2)\geqq Tp$なら、ＤＴＳｎ＋２の時点では、Ｐピクチャのスキップは起こらないと予測できる。式変形すると、$VBV(n+2)=VBV(n+1)-Eb+R\geqq Tp=Ep$となり、$VBV(n+1)\geqq Eb+(Ep-R)$の式を満たす必要がある。

【００４８】また、実施の形態１と同様に、$VBV(n+1)\geqq Eb$であることが必要であるから、結局、$VBV(n+1)\geqq MAX(Eb,Eb+(Ep-R))$の式を満たす必要がある。従って、閾値$Tb2=MAX(Eb,Eb+(Ep-R))$とし、ＤＴＳｎ＋１の時点で、ＶＢＶがＴｂ２未満の場合には、Ｂ２ピクチャをスキップすることにし、予測上Ｐピクチャのスキップが起こらないようにすることができる。

【００４９】これは、$(Ep-R)\geqq 0$のときには、図９に示すように、新たな閾値Ｔｂ２は、元のＴｂ２に（Ｅｐ－Ｒ）（図９の①に相当する量。）を加えたことになる。また、$(Ep-R)<0$のときには、閾値Ｔｂ２は、元のＴｂ２のままである。同様に、ＤＴＳｎの時点で、ＶＢＶ（ｎ）とすると、ＤＴＳｎ＋２の時点では、$VBV(n+2)=VBV(n)-Eb+R-Eb+R=VBV(n)-Eb-(Eb-2R)$となる。$VBV(n+2)\geqq Tp$なら、ＤＴＳｎ＋２の時点では、Ｐピクチャのスキップは起こらないと予測できる。式変形すると、$VBV(n+2)=VBV(n)-Eb-(Eb-2R)\geqq Tp=Ep$となり、$VBV(n)\geqq Eb+(Ep+Eb-2R)=Eb+(Ep-R)+(Eb-R)=Eb+(Tb2-R)$の式を満たす必要がある。

【００５０】また、実施の形態１と同様に、$VBV(n)\geqq Eb$であることが必要であるから、結局、$VBV(n)\geqq MAX(Eb,Eb+(Tb2-R))$の式を満たす必要がある。従って、閾値$Tb1=MAX(Eb,Eb+(Tb2-R))$とし、ＤＴＳｎの時点で、ＶＢＶがＴｂ１未満の場合には、Ｂ１ピクチャをスキップすることにし、予測上Ｐピクチャのスキップが起こら

ないようにすることができる。また、これは、（Ｔｂ２－Ｒ）≧０のときには、図９に示すように、新たな閾値Ｔｂ１は、もとのＴｂ１に（Ｅｐ－Ｒ）（図９の①に相当する量）と（Ｅｂ－Ｒ）（図９の②に相当する量）とを加えたことになる。また、（Ｔｂ２－Ｒ）＜０のときには、閾値Ｔｂ１は、元のＴｂ１のままである。

【００５１】Ｉピクチャ直前のＢピクチャの閾値についてもＥｐがＥｉに代るだけで、その他は同様である。Ｉピクチャとをピクチャとを区別するために、Ｐピクチャ直前のＢ１ピクチャの閾値をＴｂ２（ｐ）、Ｐピクチャ直前のＢ２ピクチャの閾値をＴｂ１（ｐ）、Ｉピクチャ直前のＢ２ピクチャの閾値をＴｂ２（ｉ）、Ｉピクチャ直前のＢ２ピクチャの閾値をＴｂ１（ｉ）とすると、以下の式が成立する。

【００５２】

Ｔｂ２（ｐ）＝ＭＡＸ（Ｅｂ、Ｅｂ＋（Ｅｐ－Ｒ））

Ｔｂ１（ｐ）＝ＭＡＸ（Ｅｂ、Ｅｂ＋（Ｔｂ２（ｐ）－Ｒ））

Ｔｂ２（ｉ）＝ＭＡＸ（Ｅｂ、Ｅｂ＋（Ｅｉ－Ｒ））

Ｔｂ１（ｉ）＝ＭＡＸ（Ｅｂ、Ｅｂ＋（Ｔｂ２（ｉ）－Ｒ））

図１０（ａ）は、第１の実施形態における閾値での受信バッファの予測蓄積量の遷移を示す。ＤＴＳｎ、ＤＴＳｎ＋１の時点では、受信バッファの予測蓄積量ＶＢＶが閾値Ｔｂ１、Ｔｂ２以上より、Ｂピクチャのスキップが発生せずに、ＤＴＳｎ＋２の時点では、ＶＢＶが閾値Ｔｐ未満となるので、Ｐピクチャのスキップが発生する。

【００５３】図１０（ｂ）は、本実施の形態における閾値での受信バッファの予測蓄積量の遷移を示す。同図に示すように、閾値Ｔｂ１が高く設定されたため、ＤＴＳｎの時点でＢ１ピクチャのスキップが発生する。これにより、受信バッファの予測蓄積量ＶＢＶがＢ１ピクチャのビット発生量とオールスキップＢピクチャ量の差分（Ｄｂ１－Ｄｓｋｉｐ）だけ増加し、ＤＴＳｎ＋２の時点では、受信バッファの予測蓄積量ＶＢＶが閾値Ｔｐ以上となるので、Ｐピクチャのスキップは発生しない。

【００５４】図１１（ａ）は、復号化装置で通常表示される画面の例を示す。第１、第２、第３、第４フレームで、それぞれ、Ｉ（１）、Ｂ（３）、Ｂ（４）、Ｐ（２）の復号化画像が表示される。（）内の数字は符号化する順序を示す。図１１（ｂ）は、第１の実施形態の閾値でピクチャのスキップを判定した場合に、復号化装置で表示される画面の例を示す。第１の実施形態で設定される閾値では、Ｐピクチャよりも前のＢピクチャでスキップしやすく閾値が設定されていないので、Ｐピクチャでスキップが発生しやすい。この場合、Ｐ（２）ピクチャがスキップされたことにより、Ｐ（２）は、Ｉ（１）の復号化画像を参照画像としているため、第４フレームでは、Ｉ（１）の復号化画像が表示される。また、Ｂ（３）、Ｂ（４）は、Ｐ（２）を参照しているので、第２、３フレームでもＩ（１）の復号化画像が表示される。

【００５５】図１１（ｃ）は、本実施の形態の閾値でピクチャのスキップを発生した場合に、復号化装置で表示される画面の例を示す。本実施の形態で設定される閾値では、Ｐピクチャよりも前のＢピクチャでスキップしやすく閾値が設定されているので、Ｂピクチャでスキップが発生しやすい。この場合、第２フレームのＢ（３）ピクチャがスキップされたことにより、Ｂ（３）は、Ｉ（１）とＰ（２）の復号化画像を参照画像としているが、第２フレームでは、より表示順序が近いＩ（１）の復号化画像が表示される。Ｂ（３）ピクチャを参照しているピクチャがないので、他のピクチャの復号化画像が通常どおり表示される。

【００５６】図１１（ｄ）は、本実施の形態の閾値でピクチャのスキップを発生した場合に、復号化装置で表示される画面の例を示す。この場合、第３フレームのＢ（４）ピクチャがスキップされたことにより、Ｂ（４）は、Ｉ（１）とＰ（２）の復号化画像を参照画像としているが、第３フレームでは、より表示順序が近いＰ（２）の復号化画像が表示される。Ｂ（４）ピクチャを参照しているピクチャがないので、他のピクチャの復号化画像が通常どおり表示される。

（動作）本実施の形態のビデオ符号化装置の動作は、図７に第１の実施形態の動作とステップＳ５０１の処理内容が異なるだけで、その他は共通する。従って、処理手順の説明は、省略する。

（まとめ）以上のように、本実施の形態に係るビデオ符号化装置によれば、Ｐピクチャでスキップが起こらないという予測条件を満たすように、Ｂピクチャの閾値を高く設定するので、通常では、Ｐピクチャでスキップが起こるような場合でも、直前のＢピクチャで先にスキップすることにより、Ｐピクチャのスキップを回避することができる。

（変形例１）本実施の形態のビデオ符号化装置は、Ｐピクチャでのスキップを回避するという、第１の実施形態にはない独自の効果を有するので、本実施の形態のビデオ符号化装置を特許２８７１３１６号に記載されているようにピクチャを生成した後一旦バッファメモリに蓄積するように構成しても、特許公報と異なる効果がある。

【００５７】すなわち、画像データを符号化してピクチャを生成し、そのピクチャを一旦バッファメモリに蓄積し、そのピクチャのビット発生量に基づいて、以下のようにＰピクチャでのスキップを避けるような閾値を設定して、スキップするか否かを判定するものとしてもよい。画像データがＩピクチャに符号化された場合の閾値Ｔｉは、そのＩピクチャのビット発生量をＤｉとすると、次式に設定する。

Ｔｉ＝Ｄｉ

また、画像データがＰピクチャに符号化された場合の閾

値Ｔｐは、そのＰピクチャのビット発生量をＤｐとすると、次式に設定する。

【００５８】Ｔｐ＝Ｄｐ

そして、画像データがＩピクチャ直前のＢピクチャに符号化された場合の閾値Ｔｂ（ｉ）は、そのＢピクチャのビット発生量をＤｂとし、Ｉピクチャの予測符号量をＥｉとし、１ピクチャの復号時間間隔当りの伝送ビット量をＲとすると、Ｉピクチャでのスキップを避けるために、次式に設定する。

【００５９】

Ｔｂ（ｉ）＝ＭＡＸ（Ｄｂ、Ｄｂ＋（Ｅｉ－Ｒ））

画像データがＰピクチャ直前のＢピクチャに符号化された場合の閾値Ｔｂ（ｐ）は、そのＢピクチャのビット発生量をＤｂとし、Ｐピクチャの予測符号量をＥｐとし、１ピクチャの復号時間間隔当りの伝送ビット量をＲとすると、Ｐピクチャでのスキップを避けるために、次式に設定する。

【００６０】

Ｔｂ（ｐ）＝ＭＡＸ（Ｄｂ、Ｄｂ＋（Ｅｐ－Ｒ））

（変形例２）図１２は、その他の閾値の設定例を示す。Ｔｉ、Ｔｐ、Ｔｂ２（ｐ）、Ｔｂ２（ｉ）は、次式のように、第２の実施形態と同様の値が設定される。

【００６１】Ｔｉ＝Ｅｉ

Ｔｐ＝Ｅｐ

Ｔｂ２（ｐ）＝ＭＡＸ（Ｅｂ、Ｅｂ＋（Ｅｐ－Ｒ））

Ｔｂ２（ｉ）＝ＭＡＸ（Ｅｂ、Ｅｂ＋（Ｅｉ－Ｒ））

第２の実施形態では、上述のようにＢ１ピクチャの閾値が高く設定されるので、スキップが発生しやすい。しかしながら、Ｂ１、Ｂ２、Ｐピクチャの実際のビット発生量が予測量よりも小さい場合には、Ｂ１ピクチャでスキップしなくても、Ｐピクチャのスキップが起こらない場合がある。従って、できるだけＰピクチャ直前のＢ２ピクチャの時まで待って、スキップするか否かを確かめた方が無用なスキップを避ける点で望ましい。

【００６２】一方、Ｂ２ピクチャの時まで待って、スキップすると判定したとしても、受信バッファの予測蓄積量がかなり少ない場合には、Ｂ２ピクチャをスキップしただけでは、Ｐピクチャのスキップを回避することができない場合もある。従って、Ｂ１ピクチャは、Ｂ２ピクチャでスキップしたとしても、なおかつ、Ｐピクチャでスキップが起こる場合に限り、スキップすることとし、そのためのＢ１ピクチャの閾値を設定する。

【００６３】図１３は、Ｐピクチャ直前のＢピクチャの閾値を説明する図である。ＤＴＳｎの時点で、ＶＢＶ（ｎ）とすると、ＤＴＳｎ＋２の時点では、ＶＢＶ（ｎ＋２）＝ＶＢＶ（ｎ）－Ｅｂ＋Ｒ－Ｄｂｓｋｉｐ＋Ｒ＝ＶＢＶ（ｎ）－Ｅｂ－（Ｄｂｓｋｉｐ－２Ｒ）となる。ここで、Ｄｂｓｋｉｐとは、オールスキップＢピクチャのビット発生量である。ＶＢＶ（ｎ＋２）≧Ｔｐなら、ＤＴＳｎ＋２の時点では、Ｐピクチャのスキップは起こらないことになる。式変形すると、ＶＢＶ（ｎ＋２）＝ＶＢＶ（ｎ）－Ｅｂ－（Ｄｂｓｋｉｐ－２Ｒ）≧Ｔｐ＝Ｅｐとなり、ＶＢＶ（ｎ）≧Ｅｂ＋（Ｅｐ＋Ｄｂｓｋｉｐ－２Ｒ）＝Ｅｂ＋（Ｅｐ－Ｒ）＋（Ｄｂｓｋｉｐ－Ｒ）＝Ｄｂｓｋｉｐ＋（Ｔｂ２－Ｒ）の式を満たす必要がある。

【００６４】また、実施の形態１と同様に、ＶＢＶ（ｎ）≧Ｅｂであることが必要であるから、結局、ＶＢＶ（ｎ）≧ＭＡＸ（Ｅｂ、Ｄｂｓｋｉｐ＋（Ｔｂ２－Ｒ））の式を満たす必要がある。従って、閾値Ｔｂ１＝ＭＡＸ（Ｅｂ、Ｄｂｓｋｉｐ＋（Ｔｂ２－Ｒ））とし、ＤＴＳｎの時点で、ＶＢＶがＴｂ１未満の場合には、Ｂ１ピクチャをスキップすることにし、予測上Ｐピクチャのスキップが起らないようにすることができる。

【００６５】これは、Ｄｂｓｋｉｐ＋（Ｔｂ２－Ｒ）≧Ｅｂのときには、図１３に示すように、新たな閾値Ｔｂ１は、もとのＴｂ１に（Ｅｐ－Ｒ）（図１３の①に相当する量）を加え、（Ｒ－Ｄｂｓｋｉｐ）（図１３の②に相当する量）を減じたことになる。また、Ｄｂｓｋｉｐ＋（Ｔｂ２－Ｒ）＜Ｅｂのときには、閾値Ｔｂ１は、元のＴｂ１のままである。

【００６６】Ｉピクチャ直前のＢピクチャの閾値についてもＥｐがＥｉに代るだけで、その他は同様である。従って、以下の式が成立する。

Ｔｂ１（ｐ）＝ＭＡＸ（Ｅｂ、Ｄｂｓｋｉｐ＋（Ｔｂ２（ｐ）－Ｒ））

Ｔｂ１（ｉ）＝ＭＡＸ（Ｅｂ、Ｄｂｓｋｉｐ＋（Ｔｂ２（ｉ）－Ｒ））

<第３の実施形態>本実施の形態は、１フレームを１ピクチャに割り当てている（フレーム構造）場合に、画像データの符号化をスキップした場合において、インタレース走査方式で表示しても、表示順序が逆転することがないようなビデオ符号化装置に関する。

（構成）本実施の形態に係るビデオ符号化装置の構成は、概ね共通する。以下、異なる点について説明する。

【００６７】画面並び替え手段は、フレーム単位で画像データの並び替えを行う。ＤＣＴ手段１１３は、フレーム単位の画像データの符号化を行っている。比較判定手段１２５は、第１の実施形態と同様に、受信バッファの予測蓄積量が閾値未満の場合には、ＤＣＴ手段１１３に次のフレームの画像データの符号化処理を中止させ、ＳＫＩＰピクチャ格納メモリ１２６からオールスキップピクチャを出力させる。

【００６８】ＳＫＩＰピクチャ格納メモリに、フォワード（表示順序が先）のボトムフィールド又はバックワード（表示順序が後）のトップフィールドを参照先とするフィールド構造用のオールスキップピクチャＰピクチャ及びオールスキップＢピクチャを格納する。これらのオールスキップピクチャの中で、スキップした画像データのフィールドに表示順序が最も近いフィールドを参照先

とするものが比較判定手段１２５により選択されて、送出される。

【００６９】図１４は、オールスキップＢピクチャのピクチャ層のピクチャヘッダとピクチャ符号化拡張を示す。同図の①に示すように、ピクチャ構造がトップフィールドに指定されている。図１５は、フレーム２をスキップする場合の参照するフィールドを示す。図１５（ａ）は、Ｍ（Ｉ又はＰピクチャの出現周期）＝１の場合を示す。フレーム２は、Ｐピクチャなので、参照フィールドとして使用可能なフィールドは、１ｔと１ｂとなる。このうち、２ｔ、２ｂのどちらも１ｂに表示順序が近いので、１ｂが２ｔ、２ｂの参照フィールドになる。

【００７０】従って、本来、１ｔ、１ｂを符号化する時点では、フォワードのボトムフィールドを参照先としているオールスキップＰピクチャが出力される。図１５（ｂ）は、Ｍ（Ｉ又はＰピクチャの出現周期）＝２の場合を示す。フレーム２は、Ｂピクチャなので、参照フィールドとして使用可能なフィールドは１ｔ、１ｂ、３ｔ、３ｂとなる。２ｔは、１ｂに表示順序が近いので、１ｂが２ｔの参照フィールドになる。２ｂは、３ｔに表示順序が近いので、３ｔが２ｂの参照フィールドになる。

【００７１】従って、本来、２ｔを符号化する時点では、フォワードのボトムフィールドを参照先としているオールスキップＢピクチャが出力される。従って、本来、２ｂを符号化する時点では、バックワードのトップフィールドを参照先としているオールスキップＢピクチャが出力される。図１５（ｃ）は、Ｍ（Ｉ又はＰピクチャの出現周期）＝３の場合を示す。フレーム２は、Ｂピクチャなので、参照フィールドとして使用可能なフィールドは１ｔ、１ｂ、４ｔ、４ｂとなる。２ｔ、２ｂとも、１ｂと表示順序が近いので、１ｂが参照フィールドになる。

【００７２】従って、本来、２ｔ、２ｂを符号化する時点においては、それぞれフォワードのボトムフィールドを参照先としているオールスキップＢピクチャが出力される。図１６は、フレーム３をスキップする場合の参照するフィールドを示す。図１６（ａ）は、Ｍ（Ｉ又はＰピクチャの出現周期）＝１の場合を示す。フレーム３は、Ｐピクチャなので、参照フィールドとして使用可能なフィールドは、２ｔと２ｂとなる。このうち、３ｔ、３ｂのどちらも２ｂに表示順序が近いので、２ｂが３ｔ、３ｂの参照フィールドになる。

【００７３】従って、本来、３ｔ、３ｂを符号化する時点では、フォワードのボトムフィールドを参照先としているオールスキップＰピクチャが出力される。図１６（ｂ）は、Ｍ（Ｉ又はＰピクチャの出現周期）＝２の場合を示す。フレーム３は、Ｐピクチャなので、参照フィールドとして使用可能なフィールドは、１ｔ、１ｂとなる。このうち、３ｔ、３ｂのどちらも１ｂに表示順序が近いので、１ｂが３ｔ、３ｂの参照フィールドになる。

【００７４】従って、本来、３ｔ、３ｂを符号化する時点では、フォワードのボトムフィールドを参照先としているオールスキップＰピクチャが出力される。また、３ｔの時点で１ｂを表示することにより、２ｔと２ｂも、表示順序の逆転を防止するため、２ｔと２ｂは、参照フィールドを１ｂとしてスキップ処理を行う。この場合も、フォワードのボトムフィールドを参照先としているオールスキップピクチャが出力される。

【００７５】図１６（ｃ）は、Ｍ（Ｉ又はＰピクチャの出現周期）＝３の場合を示す。フレーム３は、Ｂピクチャなので、参照フィールドとして使用可能なフィールドは、１ｂ、１ｔ、４ｔ、４ｂとなる。このうち、３ｔ、３ｂとも、４ｔに表示順序が近いので、４ｔが３ｔ、３ｂの参照フィールドになる。従って、バックワードのトップフィールドを参照先としているオールスキップＢピクチャが出力される。

【００７６】図１７は、Ｍ（Ｉ又はＰピクチャの出現周期）＝３の場合にフレーム４をスキップする場合の参照フィールドを示す。フレーム４は、Ｐピクチャなので、参照フィールドとして使用可能なフィールドは、１ｔ、１ｂとなる。このうち、４ｔ、４ｂのどちらも１ｂに表示順序が近いので、１ｂが４ｔ、４ｂの参照フィールドになる。

【００７７】従って、本来、４ｔ、４ｂを符号化する時点では、フォワードのボトムフィールドを参照先としているオールスキップＰピクチャが出力される。また、４ｔの時点で１ｂを表示することにより、２ｔ、２ｂ、３ｔ、３ｂも、表示順序の逆転を防止するため、２ｔ、２ｂ、３ｔ、３ｂは、参照フィールドを１ｂとしてスキップ処理を行う。この場合も、フォワードのボトムフィールドを参照先としているオールスキップピクチャが出力される。

（動作）次に。本実施の形態に係るビデオ符号化装置の動作について説明する。

【００７８】図１８及び図１９は、本実施の形態に係るビデオ符号化装置におけるＭ（Ｉ又はＰピクチャの出現周期）＝３の場合の動作手順を示すフロチャートである。閾値の設定（Ｓ５０１）と、スキップするか否かの判定（Ｓ５０２、Ｓ５０３、Ｓ５０７、Ｓ５０８、Ｓ５１１、Ｓ５１２、Ｓ５１５）、Ｉピクチャとしての符号化処理（Ｓ５０４）、Ｐピクチャとしての符号化処理（Ｓ５０９）、Ｂピクチャとしての符号化処理（Ｓ５１３）の動作は、第１の実施形態と同一なので、説明は省略する。

【００７９】本実施の形態は、Ｓ８０１～Ｓ８１０に示すピクチャのスキップ方法が第１の実施形態と異なるので、これらのステップを説明する。本実施の形態では、スキップする際には、フレーム構造をフィールド構造に切替えるので、１画面分のトップフィールドとボトムフ

ィールドの２つのオールスキップピクチャを出力する。すなわち、ピクチャのスキップが２度行われる。

【００８０】ステップＳ５１２において、ＶＢＶ＜Ｔｂ１の場合には、ステップＳ８０７及びステップＳ８０８において、フォワードのボトムフィールドを参照先とするオールスキップＢピクチャが２度出力される。（参照先の例は、図１５（ｃ）を参照）。ステップＳ５１５において、ＶＢＶ＜Ｔｂ２の場合には、ステップＳ８０９及びステップＳ８１０において、バックワードのトップフィールドを参照先とするオールスキップＢピクチャが２度出力される。（参照先の例は、図１６（ｃ）を参照）。

【００８１】ステップＳ５０８において、ＶＢＶ＜Ｔｐの場合には、ステップＳ８０１及びＳ８０２において、フォワードのボトムフィールドを参照先とするオールスキップＰピクチャが２度出力される（参照先の例は、図１７を参照）。そして、ステップＳ８０３～Ｓ８０６において、スキップしたＰピクチャと、その参照先のＩピクチャとの間のＢピクチャの代わりに、フォワードのボトムフィールドを参照先とするオールスキップＢピクチャがそれぞれ出力される（参照先の例は、図１７を参照）。

【００８２】そして、ステップＳ５０５において、受信バッファ蓄積量予測手段１２４が、生成したピクチャのビット発生量、又は２個若しくは６個のオールスキップピクチャのビット発生量と、ＤＴＳ時間間隔ごとの伝送ビット量Ｒとにより、次のＤＴＳ時点での復号化前の受信バッファの予測蓄積量ＶＢＶを算出する。

（まとめ）以上のように本実施の形態に係るビデオ符号化装置によれば、１フレームを１ピクチャに割り当てている（フレーム構造）場合に、受信バッファの予測蓄積量が閾値未満になったときには、画像データのフレーム構造での符号化を中止させ、表示順序が最も近いフィールドを参照先としたフィールド構造のオールスキップピクチャが送出されるので、画像データの符号化をスキップした場合に、インタレース走査方式で表示しても、表示順序が逆転しないようにすることができる。

（変形例）本実施の形態に係るビデオ符号化装置では、受信バッファの予測蓄積量に基づいて、ピクチャをスキップするか否かを判定したが、これに限定するものではない。例えば、ビデオ符号化装置側の出力バッファの蓄積量に基づいて、ピクチャをスキップするか否かを判定するものとしてもよい。

【００８３】

【発明の効果】上記目的を達成するために、本発明は、復号化装置における受信バッファの蓄積量を予測しながら、１フレーム又は１フィールドの画像データを符号化するビデオ符号化装置であって、画像データを符号化する前に、当該画像データの符号化データの復号化時刻において受信バッファに蓄積されているであろうと予測される予測蓄積量と、所定の閾値とを比較する比較手段と、予測蓄積量が閾値未満の場合には、前記画像データの符号化を中止し、前記復号化時刻に受信バッファから取出されるデータとして、前記画像データの符号化データの代わりに、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを用いるスキップ手段とを備えたことを特徴とする。

【００８４】これにより、画像データを符号化する前に符号化を中止するか否かを判定するので、受信バッファの予測蓄積量が閾値未満となるか判断するために画像データの符号化データを一時的に蓄積しておくための特別のバッファを不要にすることができる。ここで、前記ビデオ符号化装置であって、さらに、画像データが符号化されるピクチャのタイプ（Ｉピクチャ、Ｐピクチャ又はＢピクチャ）ごとに閾値を設定する閾値設定手段をを含むことを特徴とする。

【００８５】これにより、Ｉピクチャ、Ｐピクチャ、Ｂピクチャごとに符号化方法が異なるため、符号量のオーダーも異なるので、ピクチャタイプに応じた適切に閾値を設定することができる。ここで、前記スキップ手段は、ピクチャタイプがＢピクチャの場合には、スライス層の最初と最後を除いた残りのすべてのマクロブロックがスキップドマクロブロックで構成されるＢピクチャであるオールスキップＢピクチャをプロキシコードとして用い、ピクチャタイプがＩ又はＰピクチャの場合には、スライス層の最初と最後を除いた残りのすべてのマクロブロックがスキップドマクロブロックで構成されるＰピクチャであるオールスキップＰピクチャをプロキシコードとして用いることを特徴とする。

【００８６】これにより、ＭＰＥＧのスキップドマクロブロックを用いて、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを作成することができる。ここで、前記閾値設定手段の閾値は、予測符号量であることを特徴とする。これにより、Ｉ、Ｐ、Ｂのピクチャタイプごとのピクチャの予測符号量を閾値に設定するので、受信バッファのアンダーフローを高精度に防止することができる。

【００８７】ここで、前記閾値設定手段は、１画像データごとに、画素値の分散値を算出し、当該分散値が大きいほど、より大きな閾値を設定することを特徴とする。これにより、画像データの画素の分散値が大きいほど、一般的にその画像データの符号量が大きくなるので、分散値の大きな画像データにより大きな閾値を設定することで、受信バッファのアンダーフローをより高精度に防止することができる。

【００８８】ここで、前記閾値設定手段は、マクロブロックｊ内に含まれる８ブロック（フレームＤＣＴモードにおける４ブロックとフィールドＤＣＴモードにおける４ブロック）の各ブロックにおける画像データの画素値の分散値のうちの最小値をVAR_jとし、マクロブロッ

クjのアクティビティをact_jとし、$act_j=1+VAR_j$とし、画像データのアクティビティACTをすべてのマクロブロックのアクティビティの総和としたときに、画像データのアクティビティACTが大きな画像ほど、より大きな閾値を設定することを特徴とする。

【0089】これにより、画像データのアクティビティが大きいほど、一般的にその画像データの符号量が大きくなるので、アクティビティの大きな画像データにより大きな閾値を設定することで、受信バッファのアンダーフローをより高精度に防止することができる。ここで、前記閾値設定手段は、I又はPピクチャについては、それぞれの予測符号量を閾値に設定し、Bピクチャについては、Bピクチャの予測符号量よりも大きな値を閾値に設定することを特徴とする。

【0090】これにより、Bピクチャの閾値は、予測符号量よりも高く設定され、Bピクチャでのスキップしやすくなるので、他のピクチャに参照されるI又はPピクチャでのスキップが起こりくくすることができ、その結果、同一の画像が何回も連続して表示されるのを防止することができる。ここで、前記閾値設定手段は、M（I又はPピクチャの出現周期）≧2の場合に、Iピクチャの予測符号量をEi、Pピクチャの予測符号量をEp、Bピクチャの予測符号量をEb、1ピクチャの復号時間間隔当りの伝送ビット量をRとしたときに、Iピクチャの閾値$Ti=Ei$、Pピクチャの閾値$Tp=Ep$、符号化順序がIピクチャの直前のBピクチャの閾値をTb（i）とすると、

$$Tb(i)=Eb+(Ei-R) \quad (Ei-R)\geqq 0のとき、$$
$$Tb(i)=Eb \quad (Ei-R)<0のとき、$$

符号化順序がPピクチャの直前のBピクチャの閾値をTb（p）とすると、

$$Tb(p)=Eb+(Ep-R) \quad (Ep-R)\geqq 0のとき、$$
$$Tb(p)=Eb \quad (Ep-R)<0のとき、$$

とすることを特徴とする。

【0091】これにより、I又はPピクチャでスキップが起こらないように、I又はPピクチャの予測符号量に基づいて、I又はPピクチャ直前のBピクチャの閾値を設定することができる。ここで、前記閾値設定手段は、M（I又はPピクチャの出現周期）≧3の場合に、Iピクチャの予測符号量をEi、Pピクチャの予測符号量をEp、Bピクチャの予測符号量をEb、1ピクチャの復号時間間隔当りの伝送ビット量をRとしたときに、Iピクチャの閾値$Ti=Ei$、Pピクチャの閾値$Tp=Ep$、符号化順序がIピクチャの直前のBピクチャ（B2（i））の閾値をTb2（i）とすると、$Tb2(i)=Eb+(Ei-R)$　$(Ei-R)\geqq 0$のとき、$Tb2(i)=Eb$　$(Ei-R)<0$のとき、符号化順序がB2（i）直前のBピクチャ（B1（i））の閾値をTb1（i）とすると、

$$Tb1(i)=Eb+(Tb2(i)-R) \quad (Tb2(i)-R)\geqq 0のとき、$$
$$Tb1(i)=Eb \quad (Tb2(i)-R)<0のとき、$$

符号化順序がPピクチャ直前のBピクチャ（B2（p））の閾値をTb2（p）とすると、

$$Tb2(p)=Eb+(Ep-R) \quad (Ep-R)\geqq 0のとき、$$
$$Tb2(p)=Eb \quad (Ep-R)<0のとき、$$

符号化順序がB2（p）直前のBピクチャ（B1（p））の閾値をTb1（p）とすると、

$$Tb1(p)=Eb+(Tb2(p)-R) \quad (Tb2(p)-R)\geqq 0のとき、$$
$$Tb1(p)=Eb \quad (Tb2(p)-R)<0のとき、$$

とすることを特徴とする。

【0092】これにより、I又はPピクチャでスキップが起こらないように、I又はPピクチャの予測符号量に基づいて、I又はPピクチャ直前のBピクチャ及び当該Bピクチャ直前のBピクチャの閾値を設定することができる。ここで、前記閾値設定手段は、M（I又はPピクチャの出現周期）≧3のときに、符号化順序がIピクチャの直前のBピクチャ（B2）の閾値を、符号化順序が当該Bピクチャ（B2）の直前のBピクチャ（B1）の閾値よりも高く設定することを特徴とする。

【0093】これにより、I又はPピクチャでのスキップを回避するためのBピクチャのスキップは、I又はPピクチャの直前で起こりやすくすることができ、I又はPピクチャでスキップが必要かどうかの不確実性の高い時点、つまり、多数の予測項目に基づいてPピクチャの復号化時刻の受信バッファの蓄積量を予測している時点において、無用なBピクチャでのスキップを回避することができる。

【0094】ここで、前記閾値設定手段は、M（I又はPピクチャの出現周期）≧3の場合に、Iピクチャの予測符号量をEi、Pピクチャの予測符号量をEp、Bピクチャの予測符号量をEb、1ピクチャの復号時間間隔当りの伝送ビット量R、オールスキップBピクチャの符号量をDbskipとしたときに、Iピクチャの閾値$Ti=Ei$、Pピクチャの閾値$Tp=Ep$、符号化順序がIピクチャの直前のBピクチャ（B2（i））の閾値Tb2（i）とすると、

$$Tb2(i)=Eb+(Ei-R) \quad (Ei-R)\geqq 0のとき、$$

Ｔｂ２（ｉ）＝Ｅｂ

符号化順序がＢ２（ｉ）直前のＢピクチャ（Ｂ１（ｉ））の閾値をＴｂ１（ｉ）とすると、

Ｔｂ１（ｉ）＝Ｄｂｓｋｉｐ＋（Ｔｂ２（ｉ）－Ｒ）

Ｄｂｓｋｉｐ＋（Ｔｂ２（ｉ）－Ｒ）≧Ｅｂのとき、　＊

Ｔｂ２（ｐ）＝Ｅｂ＋（Ｅｐ－Ｒ）

Ｔｂ２（ｐ）　　＝Ｅｂ

符号化順序がＢ２（ｐ）直前のＢピクチャ（Ｂ１（ｐ））の閾値をＴｂ１（ｐ）とすると、

Ｔｂ１（ｐ）＝Ｄｂｓｋｉｐ＋（Ｔｂ２（ｐ）－Ｒ）

Ｄｂｓｋｉｐ＋（Ｔｂ２（ｐ）－Ｒ）≧Ｅｂのとき

Ｔｂ１（ｐ）＝Ｅｂ

Ｄｂｓｋｉｐ＋（Ｔｂ２（ｐ）－Ｒ）＜Ｅｂのとき

とすることを特徴とする。

【００９５】これにより、Ｉ又はＰピクチャでのスキップを回避するために、Ｂ２ピクチャでスキップするときに限り、Ｂ１ピクチャでもスキップするので、Ｉ又はＰピクチャでスキップが必要かどうかの不確実性の高い時点、つまり、多数の予測項目に基づいてＰピクチャの復号化時刻の受信バッファの蓄積量を予測している時点において、無用なＢ１ピクチャでのスキップを回避することができる。　※

Ｔｂ（ｉ）＝Ｄｂ＋（Ｅｉ－Ｒ）

Ｔｂ（ｉ）＝Ｄｂ

に設定し、符号化順序がＰピクチャ直前のＢピクチャに画像データが符号化された場合の閾値Ｔｂ（ｐ）は、そのＢピクチャの符号量をＤｂとし、Ｐピクチャの予測符★

Ｔｂ（ｐ）＝Ｄｂ＋（Ｅｐ－Ｒ）

Ｔｂ（ｐ）＝Ｄｂ

に設定する閾値設定手段と、画像データの符号後において、その画像データの符号化データの復号化時刻において受信バッファに蓄積されているであろうと予測蓄積量と、前記設定された閾値とを比較する比較手段と、予測蓄積量が閾値未満の場合には、前記復号化時刻に受信バッファから取出される前記画像データの符号化データの代わりに、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを用いるスキップ手段とを備えたことを特徴とする。

【００９７】これにより、Ｉ又はＰピクチャでスキップが起こりにくくするとともに、ピクチャの予測符号量でなく実際の符号量以上に閾値が常に設定されるので、受信バッファのアンダーフローを確実に防止することができる。また、本発明は、１フレームの画像データをフレーム構造で符号化するビデオ符号化装置であって、画像データを符号化する際に、出力バッファの蓄積量又は復号化装置の受信バッファの予測蓄積量と所定の基準値とを比較する比較手段と、前記蓄積量又は予測蓄積量が所定の基準値に達したと判定された場合に、前記画像データのフレーム構造での符号化を中止し、前記画像データのトップフィールド及びボトムフィールドの符号化デー

（Ｅｉ－Ｒ）＜０のとき、

＊Ｔｂ１（ｉ）＝Ｅｂ

Ｄｂｓｋｉｐ＋（Ｔｂ２（ｉ）－Ｒ）＜Ｅｂのとき、

符号化順序がＰピクチャ直前のＢピクチャ（Ｂ２（ｐ））の閾値をＴｂ２（ｐ）とすると、

（Ｅｐ－Ｒ）≧０のとき、

（Ｅｐ－Ｒ）＜０のとき、

※【００９６】また、本発明は、、復号化装置における受信バッファの蓄積量を予測しながら、１フレーム又は１フィールドの画像データを符号化するビデオ符号化装置であって、画像データの符号化後において、ピクチャタイプに応じて、Ｍ（Ｉ又はＰピクチャの出現周期）≧２の場合に、画像データがＩピクチャに符号化された場合の閾値Ｔｉは、当該Ｉピクチャの符号量をＤｉとすると、Ｔｉ＝Ｄｉに設定し、画像データがＰピクチャに符号化された場合の閾値Ｔｉは、当該Ｐピクチャの符号量をＤｐとすると、Ｔｐ＝Ｄｐに設定し、符号化順序がＩピクチャ直前のＢピクチャに画像データが符号化された場合の閾値Ｔｂ（ｉ）は、そのＢピクチャの符号量をＤｂとし、Ｉピクチャの予測符号量をＥｉとし、１ピクチャの復号時間間隔当りの伝送ビット量をＲとすると、

（Ｅｉ－Ｒ）≧０のとき、

（Ｅｉ－Ｒ）＜０のとき、

★号量をＥｐとし、１ピクチャの復号時間間隔当りの伝送ビット量をＲとすると、

（Ｅｐ－Ｒ）≧０のとき、

（Ｅｐ－Ｒ）＜０のとき、

タの代わりに、過去に復号化された画像データを構成するトップフィールド又はボトムフィールドと同一である２つのフィールドを表示すべき旨を定めたプロキシコードを用いるスキップ手段とを備えたことを特徴とする。

【００９８】これにより、画像データの符号化をスキップするときには、ピクチャの割当て方がフィールド構造に切り替わり、スキップした画像データの各フィールドは、トップフィールドでもボトムフィールドでも参照することができるので、スキップしたときでもフレーム構造を維持することにより表示順序が逆転するような事態を防止することができる。

【００９９】ここで、前記スキップ手段は、過去に復号化された画像データを構成するトップフィールド又及びボトムフィールドのうち、前記フレーム構造での符号化を中止した画像データの各フィールドに表示順序が最も近いフィールドと同一である２つのフィールドを表示すべき旨を定めたプロキシコードを用いることを特徴とする。

【０１００】これにより、符号化をスキップした画像データの各フィールドは、表示順序の最も近いフィールドを参照先フィールドとするので、符号化をスキップした

画像データのトップフィールドの参照先フィールドがスキップした画像データのボトムフィールドの参照先フィールドよりも表示順序が後になることがありえないので、表示順序の逆転を確実に回避することができる。

【０１０１】ここで、前記スキップ手段は、フレーム構造での符号化を中止した前記画像データが符号化される予定であったピクチャのタイプがＢピクチャの場合には、スライス層の最初と最後を除いた残りのすべてのマクロブロックがスキップドマクロブロックで構成されるＢピクチャであるオールスキップＢピクチャの２つを前記プロキシコードとし、フレーム構造での符号化を中止した前記画像データが符号化される予定であったピクチャのタイプがＩ又はＰピクチャの場合には、スライス層の最初と最後を除いた残りのすべてのマクロブロックがスキップドマクロブロックで構成されるＰピクチャであるオールスキップＰピクチャの２つを前記プロキシコードとすることを特徴とする。

【０１０２】これにより、ＭＰＥＧのスキップドマクロブロックを用いて、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを作成することができる。ここで、前記スキップ手段は、フレーム構造での符号化を中止した前記画像データが符号化される予定であったピクチャのタイプがＩ又はＰピクチャの場合において用いる前記オールスキップＰピクチャでは、表示順序が先となるＩ又はＰピクチャの画像データのボトムフィールドを参照フィールドとし、フレーム構造での符号化を中止した前記画像データが符号化される予定であったピクチャのタイプがＩ又はＰピクチャの直後に符号化されるＢピクチャ（Ｂ１）の場合において用いる前記オールスキップＢピクチャでは、表示順序が先となるＩ又はＰピクチャの画像データのボトムフィールドを参照フィールドとし、フレーム構造での符号化を中止した前記画像データが符号化される予定であったピクチャのタイプがＩ又はＰピクチャの直前に符号化されるＢピクチャ（Ｂ２）の場合において用いる前記オールスキップＢピクチャでは、表示順序が後となるＩ又はＰピクチャの画像データのトップフィールドを参照フィールドとすることを特徴とする。

【０１０３】これにより、ピクチャタイプに応じて、適切な参照フィールドを指定したオールスキップピクチャが選択されるので、表示順序の逆転を簡易かつ適切に回避することができる。ここで、前記スキップ手段は、フレーム構造での符号化を中止した前記画像データが符号化される予定であったピクチャのタイプがＩ又はＰピクチャの場合には、その後にＢピクチャに符号化される画像データの符号化を中止し、当該画像データのトップフィールド及びボトムフィールドの符号化データの代わりに、表示順序が先のボトムフィールドを参照フィールドとしたオールスキップＢピクチャの２つを用いることを特徴とする。

【０１０４】これにより、Ｐ又はＩピクチャでスキップが発生したときには、それを参照することしているＢピクチャの画像データのフィールドも、スキップした画像データのフィールドが参照先としたフィールドと同一のフィールドを参照先フィールドとすることで、表示順序の逆転を防止することができる。また、本発明は、復号化装置における受信バッファの蓄積量を予測しながら、１フレーム又は１フィールドの画像データを符号化するビデオ符号化装置であって、画像データを符号化する前に、当該画像データの符号化データの復号化時刻において受信バッファに蓄積されているであろうと予測される予測蓄積量と、画像データが符号化されるピクチャタイプごとの閾値とを比較する比較手段と、予測蓄積量が閾値未満の場合であって、前記画像データが符号化されるピクチャのタイプがＢピクチャの場合には、前記画像データの符号化を中止し、前記復号化時刻に受信バッファから取出される前記画像データの符号化データの代わりに、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを用いる制御手段とを備えたことを特徴とする。

【０１０５】これにより、受信バッファの予測蓄積量が閾値未満でもＢピクチャの場合に限りピクチャのスキップを行うので、他のピクチャに参照されるＩ又はＰピクチャについては符号量を抑制した符号化を行う等により、同一の画像が連続して表示される回数を少なくすることができる。また、本発明は、復号化装置における受信バッファの蓄積量を予測しながら、１フレーム又は１フィールドの画像データを符号化するビデオ符号化装置であって、画像データを符号化する前に、当該画像データの符号化データの復号化時刻において受信バッファに蓄積されているであろうと予測される予測蓄積量と、画像データが符号化されるピクチャタイプごとの閾値とを比較する比較手段と、予測蓄積量が閾値未満の場合であって、前記画像データが符号化されるピクチャのタイプがＢ又はＰピクチャの場合には、前記画像データの符号化を中止し、前記復号化時刻に受信バッファから取出される前記画像データの符号化データの代わりに、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを用いる制御手段とを備えたことを特徴とする。

【０１０６】これにより、受信バッファの予測蓄積量が閾値未満でもＢ又はＰピクチャの場合に限りピクチャのスキップを行うので、他のピクチャに参照されるＩピクチャについては符号量を抑制した符号化を行う等により、同一の画像が連続して表示される頻度を減らすことができる。また、本発明は、復号化装置における受信バッファの蓄積量を予測しながら、１フレーム又は１フィールドの画像データを符号化するビデオ符号化方法であって、画像データを符号化する前に、当該画像データの符号化データの復号化時刻において受信バッファに蓄積

されているであろうと予測される予測蓄積量と、所定の閾値とを比較するステップと、予測蓄積量が閾値未満の場合には、前記画像データの符号化を中止し、前記復号化時刻に受信バッファから取出されるデータとして、前記画像データの符号化データの代わりに、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを用いるステップとを含むことを特徴とする。

【０１０７】これにより、画像データを符号化する前に符号化を中止するか否かを判定するので、受信バッファの予測蓄積量が閾値未満となるか判断するために画像データの符号化データを一時的に蓄積しておくための特別のバッファを不要にすることができる。また、本発明は、１フレームの画像データをフレーム構造で符号化するビデオ符号化方法であって、画像データを符号化する際に、出力バッファの蓄積量又は復号化装置の受信バッファの予測蓄積量と所定の基準値とを比較するステップと、前記蓄積量又は予測蓄積量が所定の基準値に達したと判定された場合に、前記画像データのフレーム構造での符号化を中止し、前記画像データのトップフィールド及びボトムフィールドの符号化データの代わりに、過去に復号化された画像データを構成するトップフィールド又はボトムフィールドと同一である２つのフィールドを表示すべき旨を定めたプロキシコードを用いるステップとを含むことを特徴とする。

【０１０８】これにより、画像データの符号化をスキップするときには、ピクチャの割当て方がフィールド構造に切り替わり、スキップした画像データの各フィールドは、トップフィールドでもボトムフィールドでも参照することができるので、スキップしたときでもフレーム構造を維持することにより表示順序が逆転するような事態を防止することができる。

【０１０９】また、本発明のビデオ符号化プログラムは、復号化装置における受信バッファの蓄積量を予測しながら、１フレーム又は１フィールドの画像データを符号化するためにコンピュータを、画像データを符号化する前に、当該画像データの符号化データの復号化時刻において受信バッファに蓄積されているであろうと予測される予測蓄積量と、所定の閾値とを比較する比較手段と、予測蓄積量が閾値未満の場合には、前記画像データの符号化を中止し、前記復号化時刻に受信バッファから取出されるデータとして、前記画像データの符号化データの代わりに、過去に復号化された画像データと同一の画像データを表示すべき旨を定めたプロキシコードを用いるスキップ手段として機能させる。

【０１１０】これにより、画像データを符号化する前に符号化を中止するか否かを判定するので、受信バッファの予測蓄積量が閾値未満となるか判断するために画像データの符号化データを一時的に蓄積しておくための特別のバッファを不要にすることができる。また、本発明のビデオ符号化プログラムは、１フレームの画像データをフレーム構造で符号化するためにコンピュータを、画像データを符号化する際に、出力バッファの蓄積量又は復号化装置の受信バッファの予測蓄積量と所定の基準値とを比較する比較手段と、前記蓄積量又は予測蓄積量が所定の基準値に達したと判定された場合に、前記画像データのフレーム構造での符号化を中止し、前記画像データのトップフィールド及びボトムフィールドの符号化データの代わりに、過去に復号化された画像データを構成するトップフィールド又はボトムフィールドと同一である２つのフィールドを表示すべき旨を定めたプロキシコードを用いるスキップ手段として機能させる。

【０１１１】これにより、画像データの符号化をスキップするときには、ピクチャの割当て方がフィールド構造に切り替わり、スキップした画像データの各フィールドは、トップフィールドでもボトムフィールドでも参照することができるので、スキップしたときでもフレーム構造を維持することにより表示順序が逆転するような事態を防止することができる。

【図面の簡単な説明】

【図１】ビデオ符号化装置１００の構成を示す。

【図２】図２（ａ）は、ビデオ画像のもともとの順序を示す。図２（ｂ）は、ビデオ画像の符号化順序を示す。

【図３】図３（ａ）は、ピクチャをスキップしない通常時の受信バッファの予測蓄積量を示す。図３（ｂ）は、ピクチャをスキップしたときの受信バッファの予測蓄積量を示す。

【図４】閾値の設定例を示す。

【図５】図５（ａ）では、Ｉピクチャをスキップする場合の受信バッファの予測蓄積量を示す。図５（ｂ）では、Ｂ１ピクチャをスキップする場合の受信バッファの予測蓄積量を示す。図５（ｃ）では、Ｂ２ピクチャをスキップする場合の受信バッファの予測蓄積量を示す。図５（ｄ）では、Ｐピクチャをスキップする場合の受信バッファの予測蓄積量を示す。

【図６】図６（ａ）は、復号化装置で通常表示される画面の例を示す。図６（ｂ）は、ピクチャをスキップしたときに、復号化装置で表示される画面の例を示す。

【図７】第１の実施形態に係るビデオ符号化装置の動作手順を示すフロチャートである。

【図８】閾値の設定例を示す。

【図９】Ｐピクチャ直前のＢピクチャの閾値を説明する図である。

【図１０】図１０（ａ）は、第１の実施形態における閾値での受信バッファの予測蓄積量の遷移を示す。図１０（ｂ）は、第２の実施形態における閾値での受信バッファの予測蓄積量の遷移を示す。

【図１１】図１１（ａ）は、復号化装置で通常表示される画面の例を示す。図１１（ｂ）は、第１の実施形態の閾値でピクチャのスキップを判定した場合に、復号化装

置で表示される画面の例を示す。図１１（ｃ）は、第２の実施形態の閾値でピクチャのスキップを発生した場合に、復号化装置で表示される画面の例を示す。図１１（ｄ）は、第２の実施形態の閾値でピクチャのスキップを発生した場合に、復号化装置で表示される画面の例を示す。

【図１２】閾値の設定例を示す。

【図１３】Ｐピクチャ直前のＢピクチャの閾値を説明する図である。

【図１４】オールスキップＢピクチャのピクチャ層のピクチャヘッダとピクチャ符号化拡張を示す。

【図１５】図１５（ａ）は、Ｍ（Ｉ又はＰピクチャの出現周期）＝１の場合を示す。図１５（ｂ）は、Ｍ（Ｉ又はＰピクチャの出現周期）＝２の場合を示す。図１５（ｃ）は、Ｍ（Ｉ又はＰピクチャの出現周期）＝３の場合を示す。

【図１６】図１６（ａ）は、Ｍ（Ｉ又はＰピクチャの出現周期）＝１の場合を示す図１６（ｂ）は、Ｍ（Ｉ又はＰピクチャの出現周期）＝２の場合を示す。図１６（ｃ）は、Ｍ（Ｉ又はＰピクチャの出現周期）＝３の場合を示す。

【図１７】Ｍ（Ｉ又はＰピクチャの出現周期）＝３の場合にフレーム４をスキップする場合の参照フィールドを示す。

【図１８】第３の実施形態に係るビデオ符号化装置の動作手順を示すフロチャートである。

【図１９】第３の実施形態に係るビデオ符号化装置の動作手順を示すフロチャートである。

【図２０】図２０（ａ）は、受信バッファの予測蓄積量の通常の遷移を示す。図２０（ｂ）は、受信バッファの予測蓄積量がアンダーフローする例を示す。図２０（ｃ）は、受信バッファの予測蓄積量がオーバーフローする例を示す。

【図２１】図２１（ａ）は、通常時に表示される画面の＊例を示す。図２１（ｂ）は、スキップドマクロブロックを用いた場合に表示される画面の例を示す。図２１（ｃ）は、擬似画像を用いたときに表示される画面の例を示す。

【図２２】特許２８７１３１６号に記載されたビデオ符号化装置の構成を示す。

【図２３】図２３（ａ）は、ピクチャをスキップしない通常時の表示画面を示す。図２３（ｂ）は、ピクチャのスキップが発生した場合の表示画面を示す。

【符号の説明】

６　直交変換回路
２０　バッファメモリ
２２　ＳＫＩＰコード格納メモリ
２４　伝送レート超過判定回路
１００　ビデオ符号化装置
１１０　画面並び替え手段
１１１　加算器
１１２　加算器
１１３　ＤＣＴ手段
１１４　量子化手段
１１５　レート制御手段
１１６　可変長符号化手段
１１７　バッファ
１１８　切替え器
１１９　逆量子化手段
１２０　逆ＤＣＴ手段
１２１　バッファメモリ
１２２　ビデオメモリ
１２３　動き補償予測手段
１２４　受信バッファ蓄積量予測手段
１２５　比較判定手段
１２６　ＳＫＩＰピクチャ格納メモリ
１２７　閾値設定手段

【図４】

$$Ti=Ei$$
$$Tp=Ep$$
$$Tb2=Eb$$
$$Tb1=Eb$$

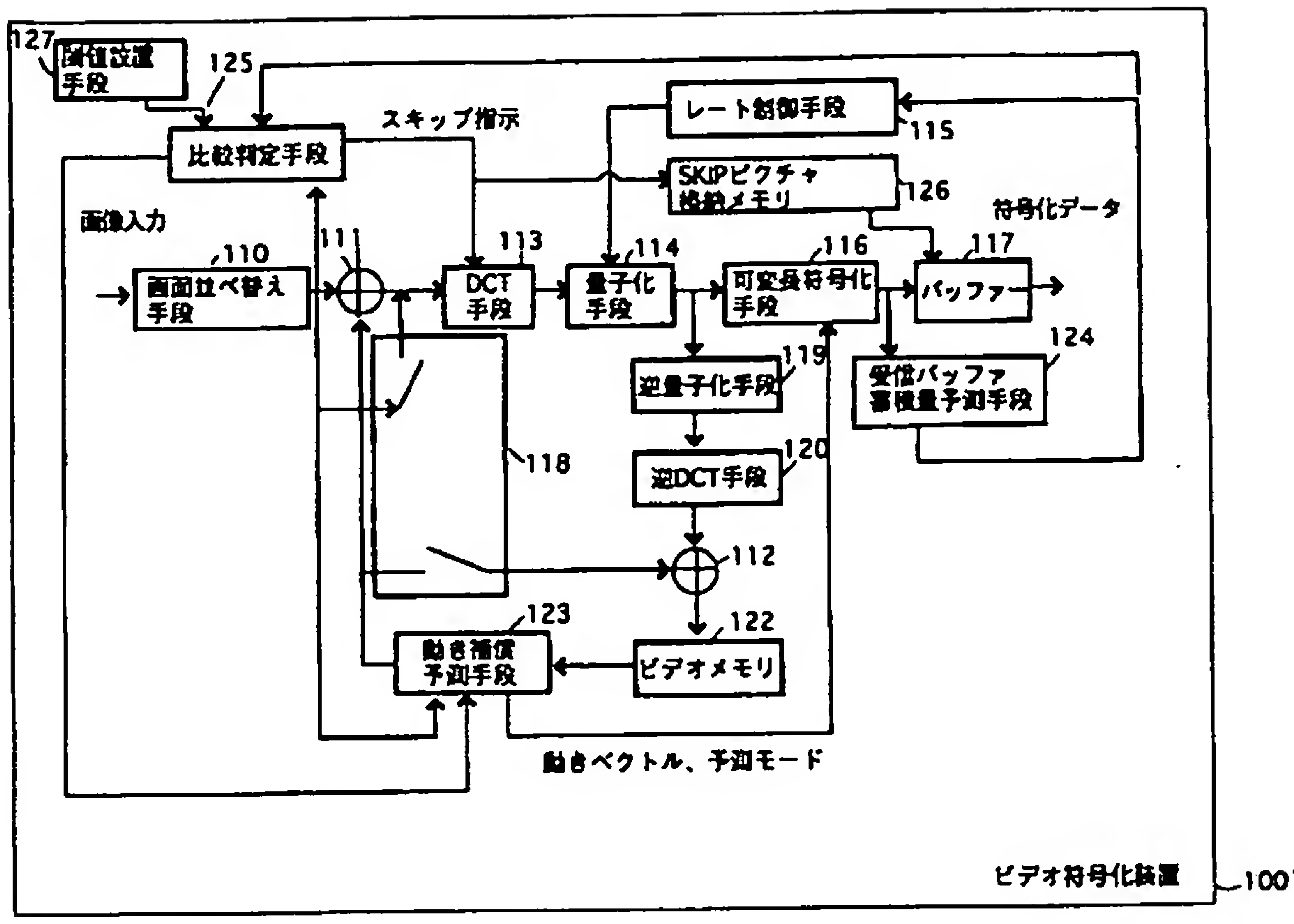
【図８】

$Ti=Ei$	
$Tp=Ep$	
$Tb2(p)=Eb+(Ep-R)$	$(Ep-R)\geqq 0$
$=Eb$	$(Ep-R)<0$
$Tb1(p)=Eb+(Tb2(p)-R)$	$(Tb2(p)-R)\geqq 0$
$=Eb$	$(Tb2(p)-R)<0$
$Tb2(i)=Eb+(Ei-R)$	$(Ei-R)\geqq 0$
$=Eb$	$(Ei-R)<0$
$Tb1(i)=Eb+(Tb2(i)-R)$	$(Tb2(i)-R)\geqq 0$
$=Eb$	$(Tb2(i)-R)<0$

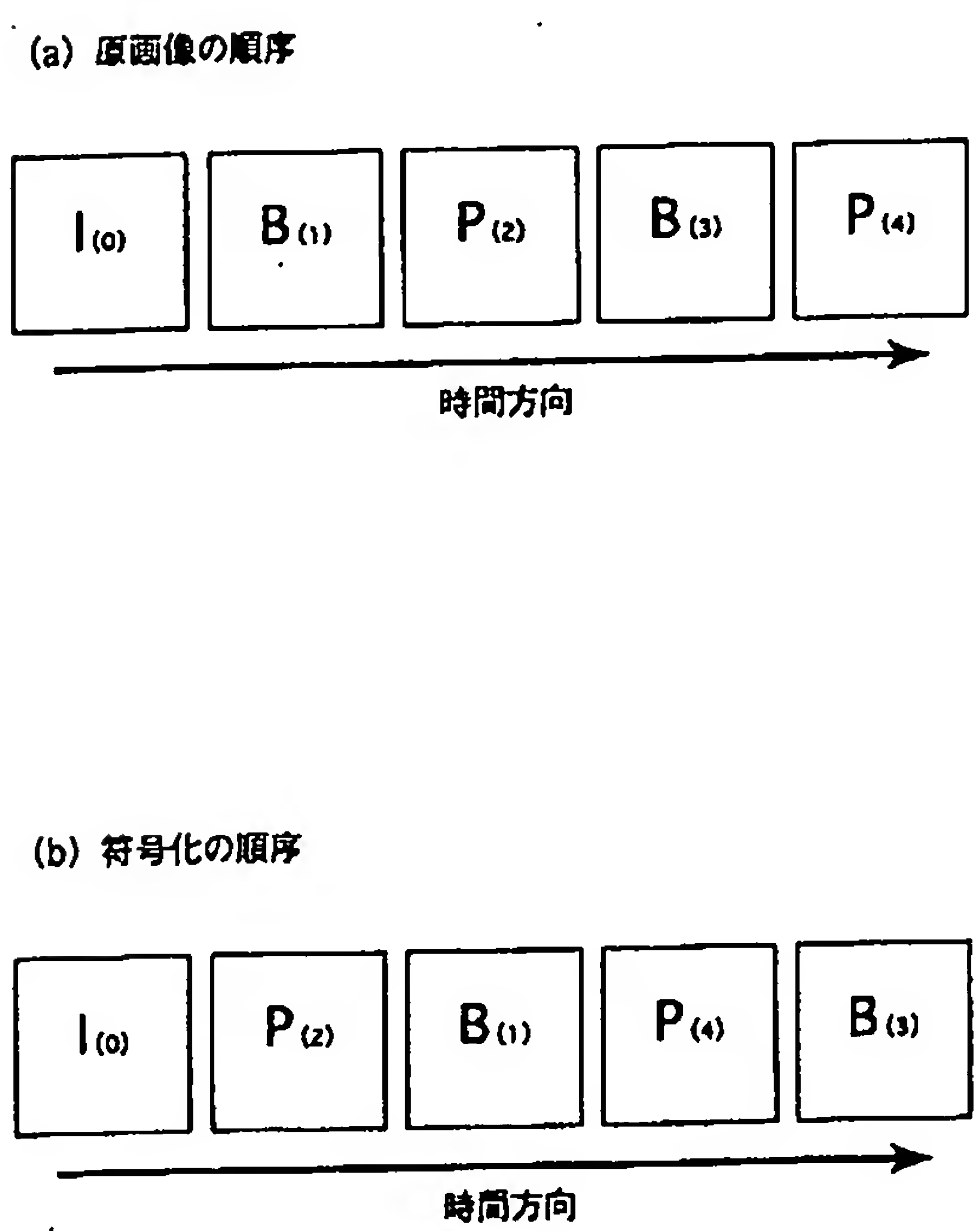
【図１２】

$Ti=Ei$	
$Tp=Ep$	
$Tb2(p)=Eb+(Ep-R)$	$(Ep-R)\geqq 0$
$=Eb$	$(Ep-R)<0$
$Tb1(p)=Dbskip+(Tb2(p)-R)$	$(Dbskip+(Tb2(p)-R))\geqq Eb$
$=Eb$	$(Dbskip+(Tb2(p)-R))<Eb$
$Tb2(i)=Eb+(Ei-R)$	$(Ei-R)\geqq 0$
$=Eb$	$(Ei-R)<0$
$Tb1(i)=Dbskip+(Tb2(i)-R)$	$(Dbskip+(Tb2(i)-R))\geqq Eb$
$=Eb$	$(Dbskip+(Tb2(i)-R))<Eb$

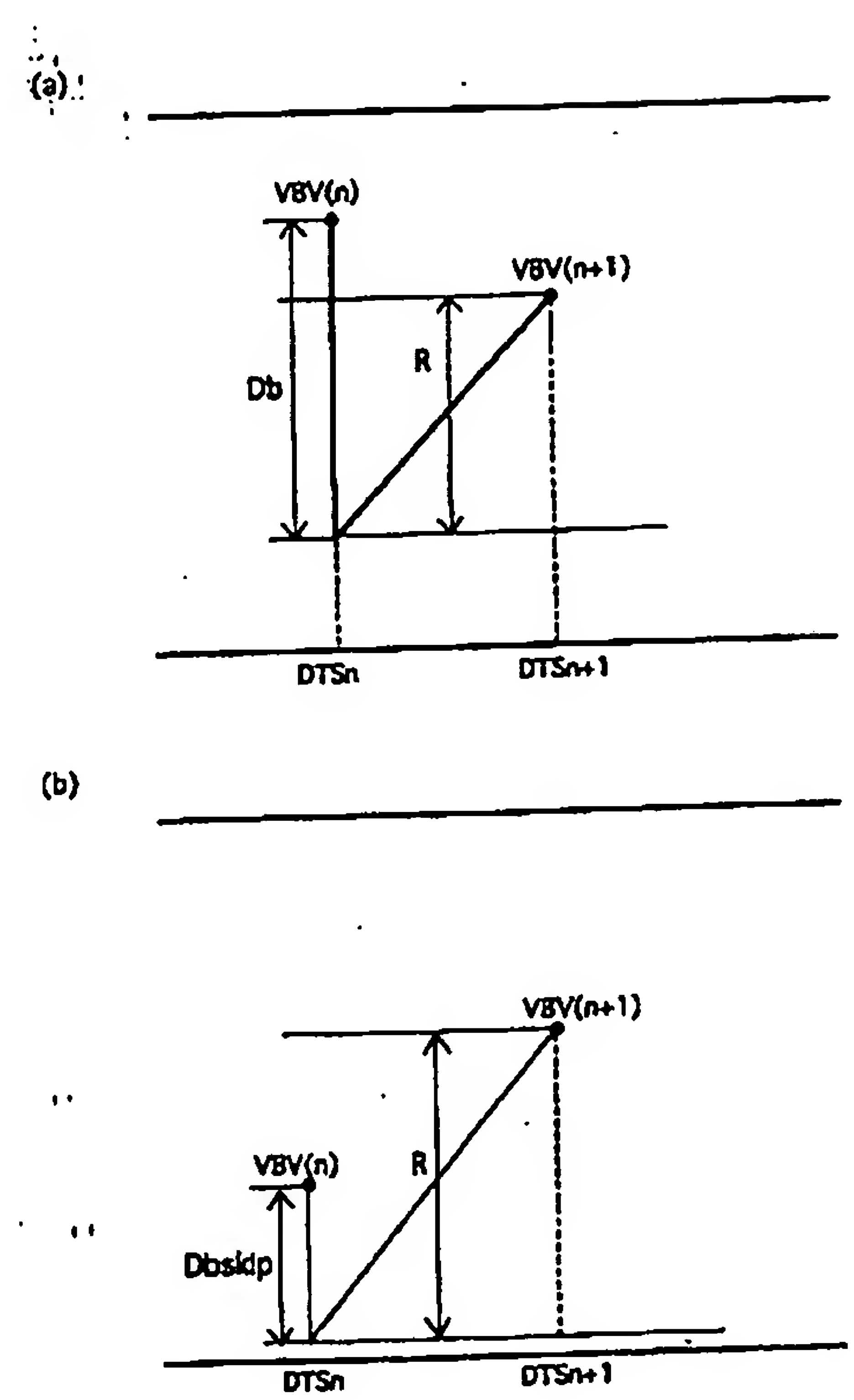
【図１】


127
閾値設定手段
125
比較判定手段
スキップ指示
レート制御手段
115
SKIPピクチャ格納メモリ
126
符号化データ
画像入力
110
画面並べ替え手段
111
113
DCT手段
114
量子化手段
116
可変長符号化手段
117
バッファー
124
受信バッファ蓄積量予測手段
119
逆量子化手段
118
120
逆DCT手段
112
123
動き補償予測手段
122
ビデオメモリ
動きベクトル、予測モード
ビデオ符号化装置
100

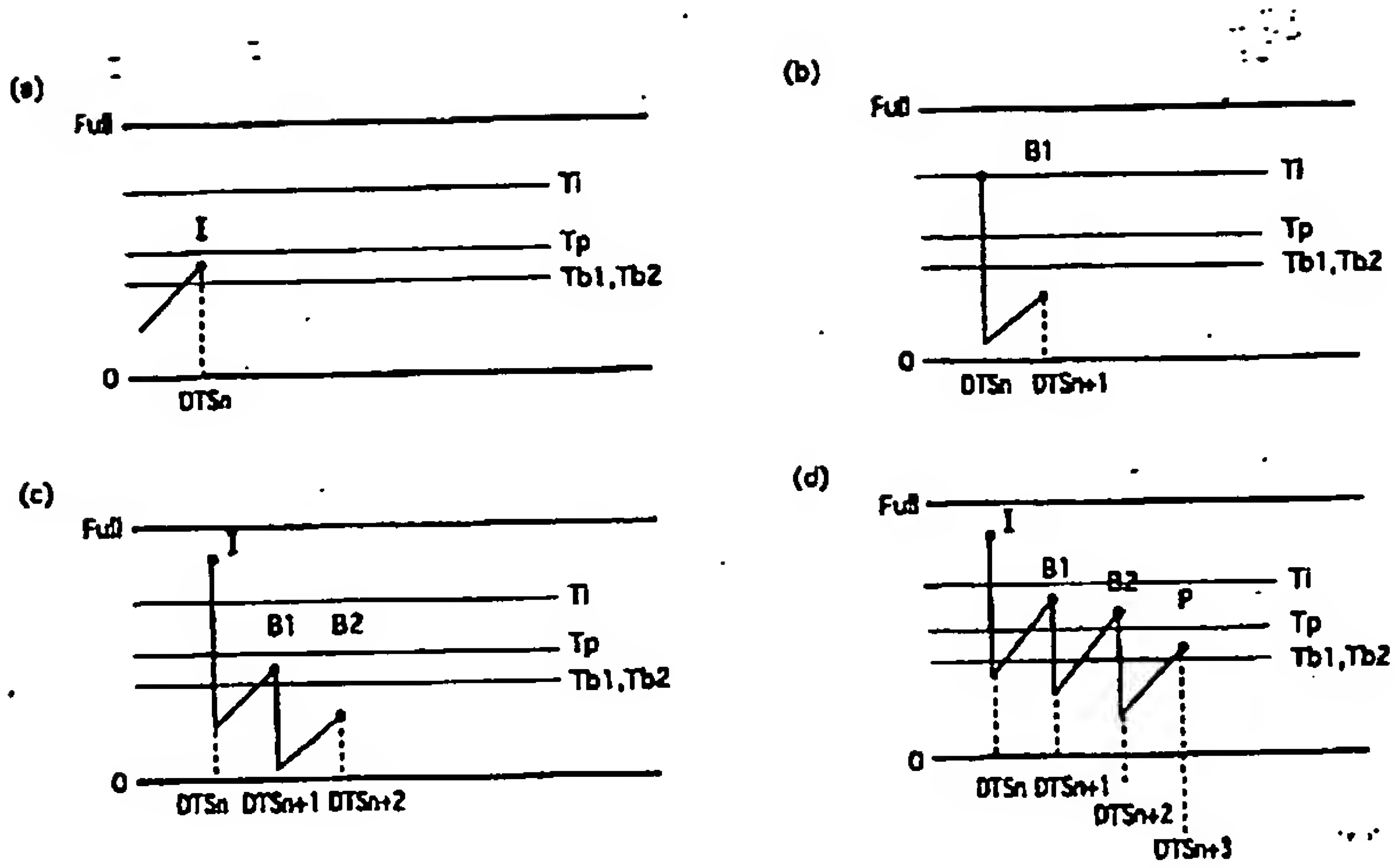
【図２】


(a) 原画像の順序
I(0)
B(1)
P(2)
B(3)
P(4)
時間方向
(b) 符号化の順序
I(0)
P(2)
B(1)
P(4)
B(3)
時間方向

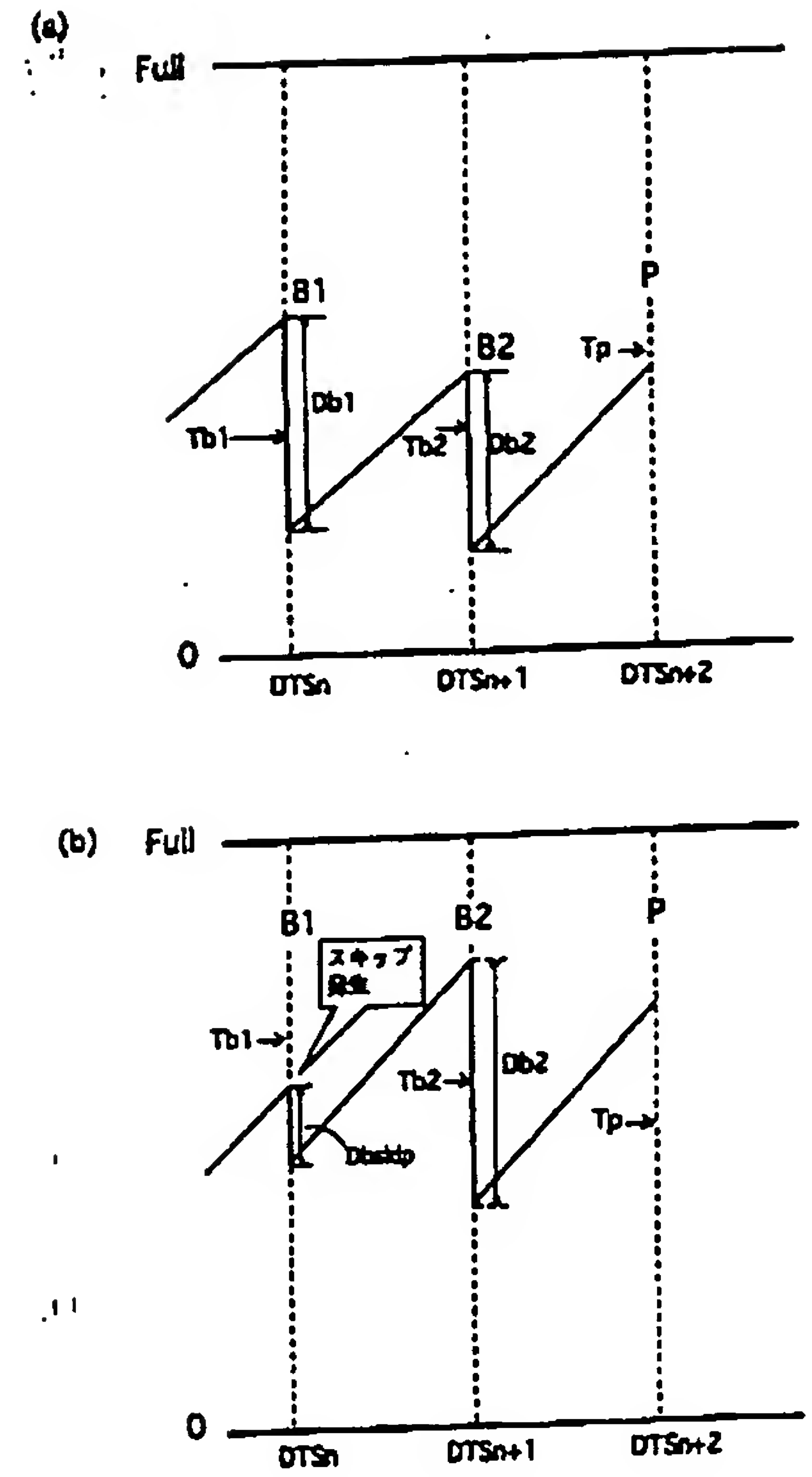
【図３】


(a)
VBV(n)
VBV(n+1)
Db
R
DTSn
DTSn+1
(b)
VBV(n+1)
VBV(n)
R
Dbskip
DTSn
DTSn+1

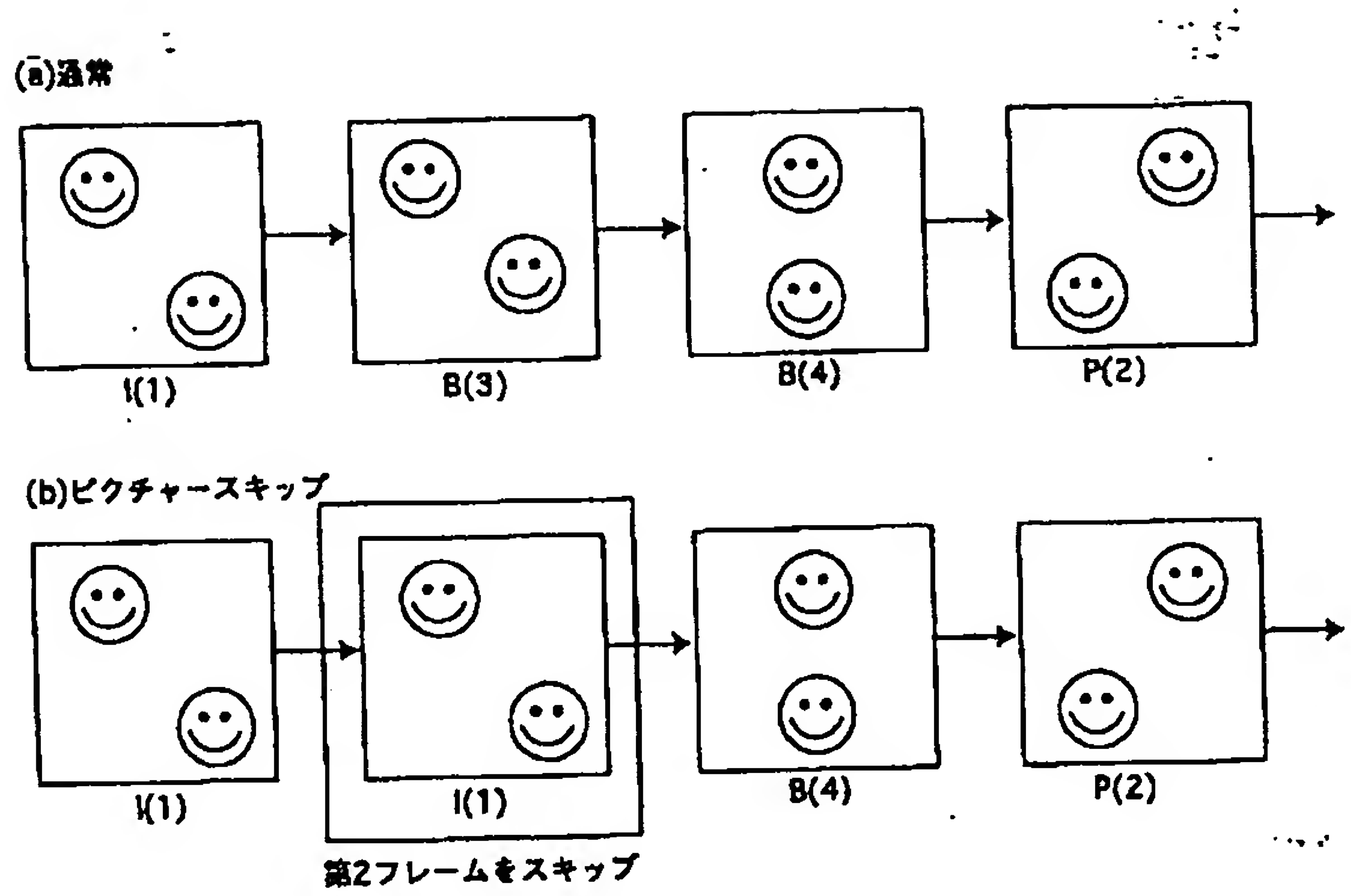
【図５】



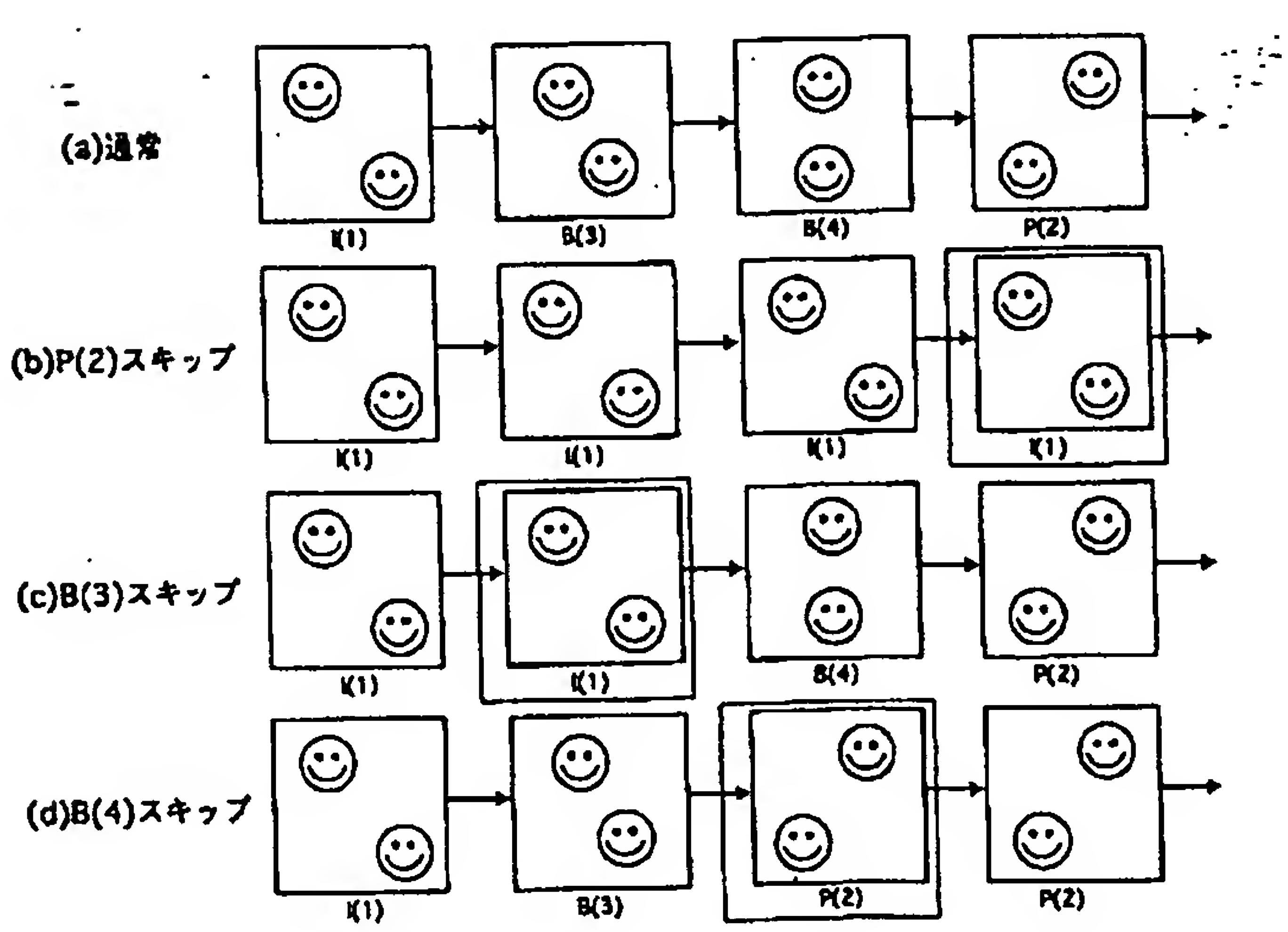
【図１０】



【図６】



【図１１】



【図１４】

MPEG2のビットストリーム構造（Bピクチャ）

Picture header

temporal_reference

picture_coding_type=3(I=1、P=2、B=3)

vbv_delay=65535

full_pel_forward_vector=0

forward_f_code=7

picture coding extension

forward horizontal f_code=2

forward vertical f_code=2

forward horizontal f_code=15

forward vertical f_code=15

intra_dc_precision=0

1

picture_structure=1(TopField=1,BottomField=2,Frame=3)

top_field_first=0

frame_pred_frame_dct=0

concealment_motion_vectors=0

q_scale_type=1

intra_vlc_format=0

alternate_scan=0

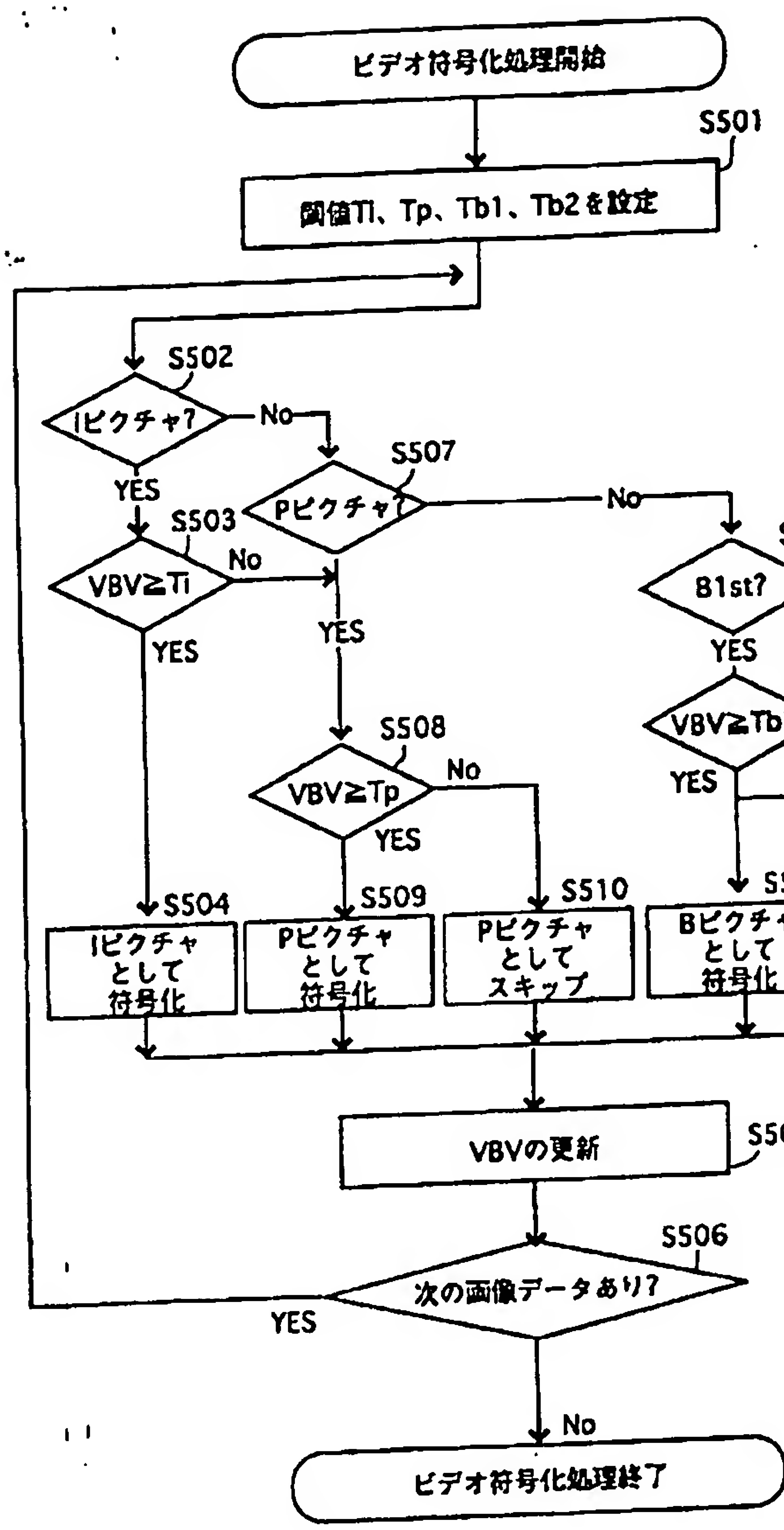
repeat_first_field=0

chroma_420_type=0

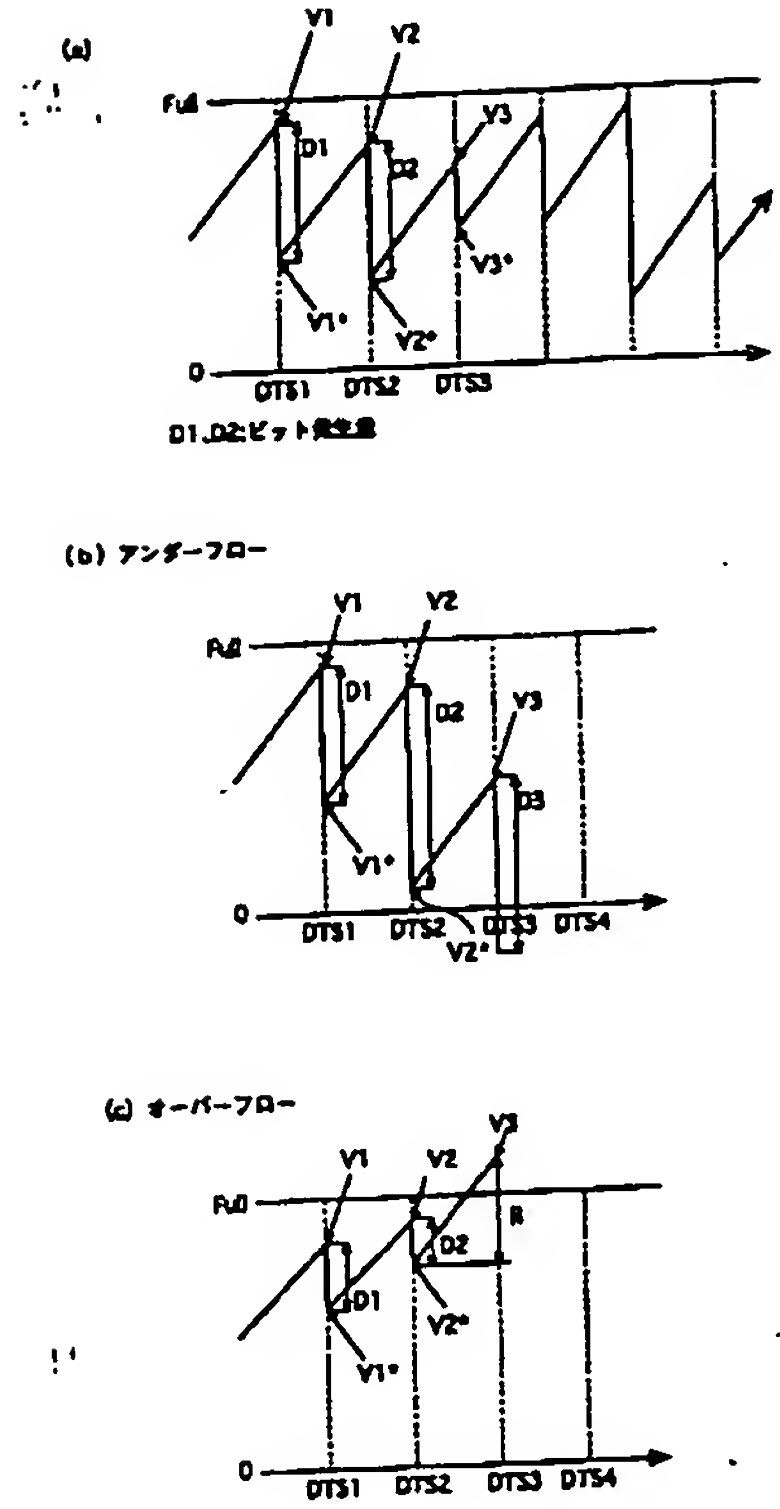
progressive_frame=0

composite_display_flag=0

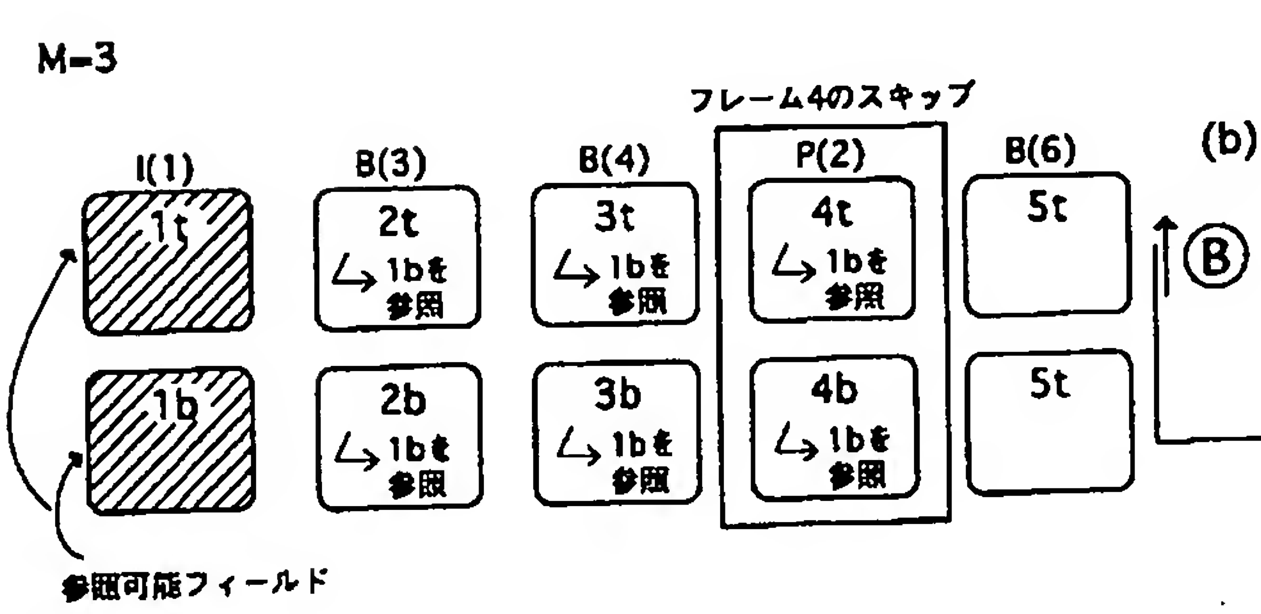
【図７】



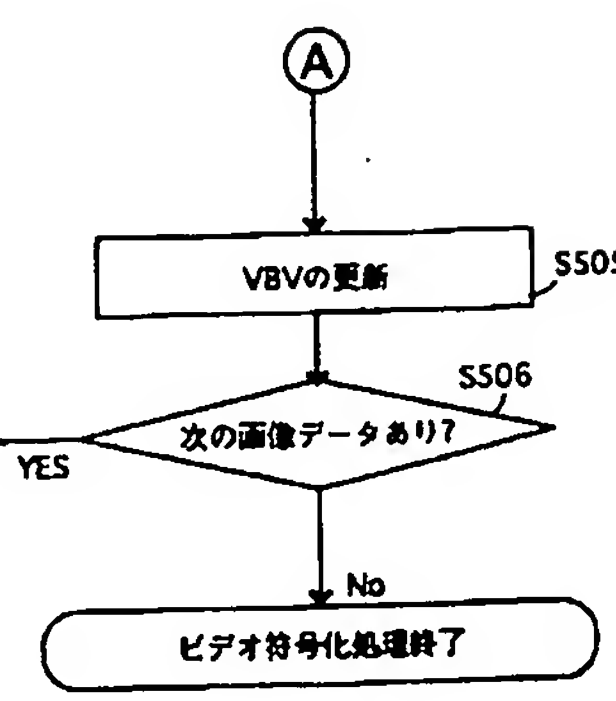
【図２０】



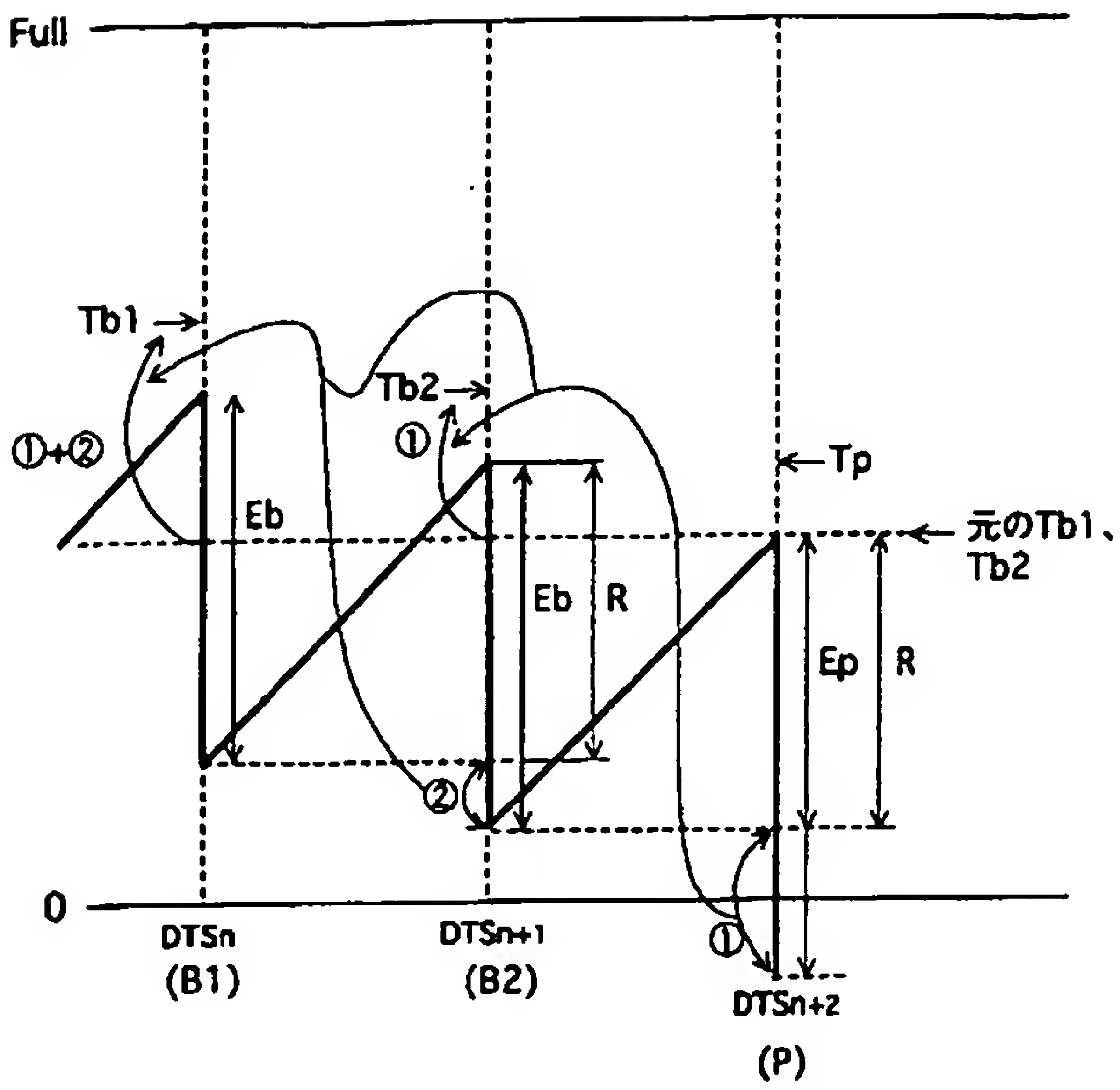
【図１７】



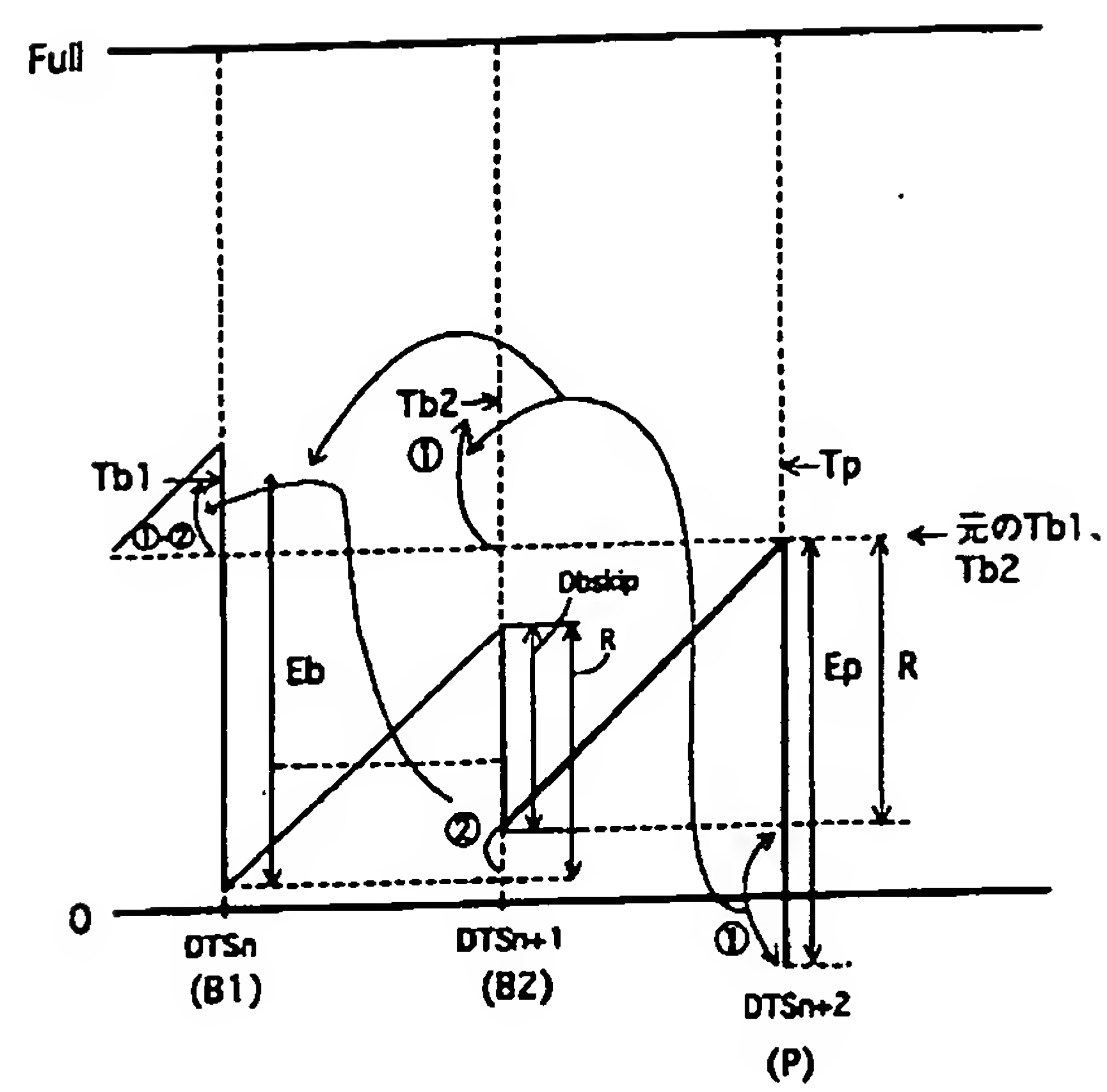
【図１９】



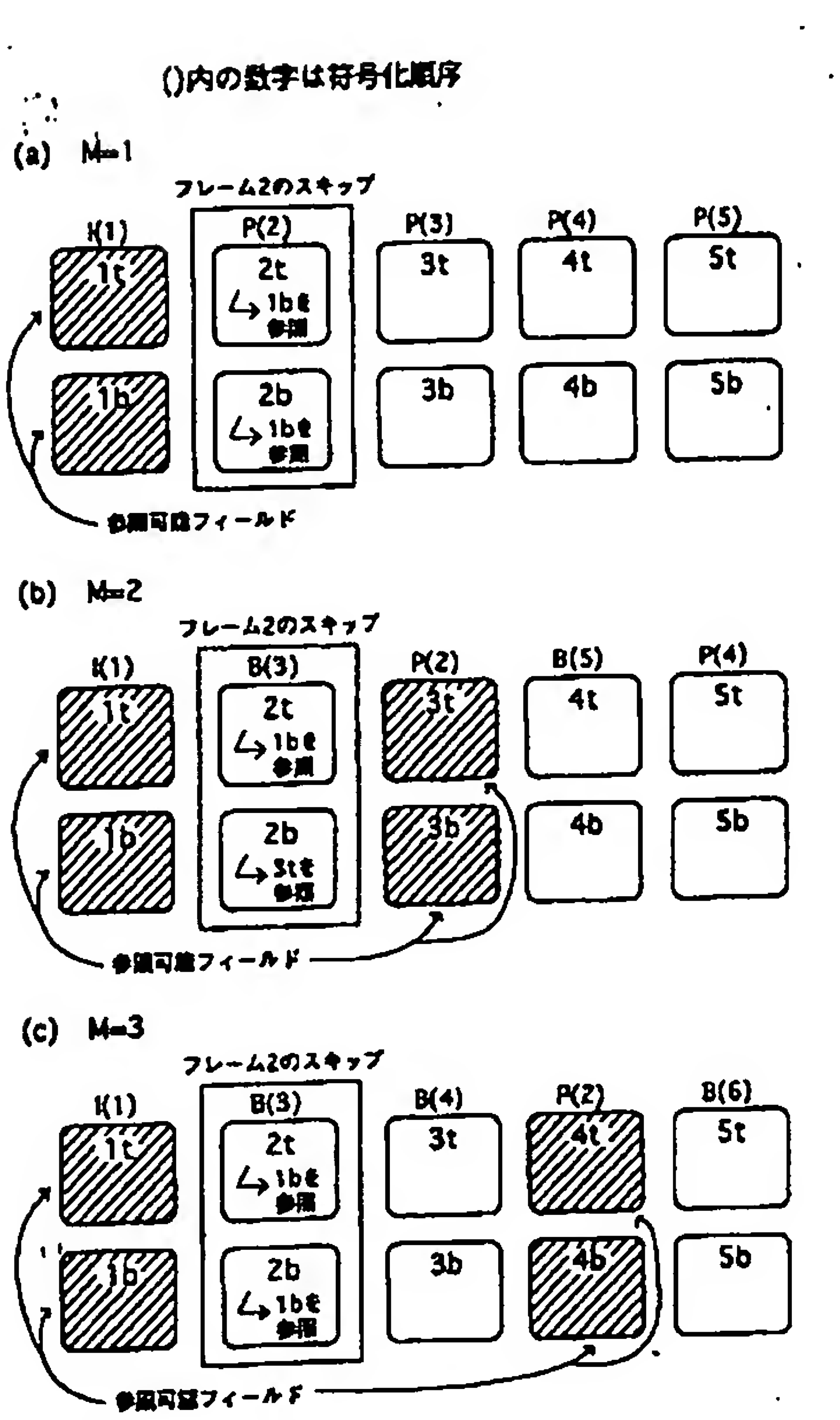
【図9】



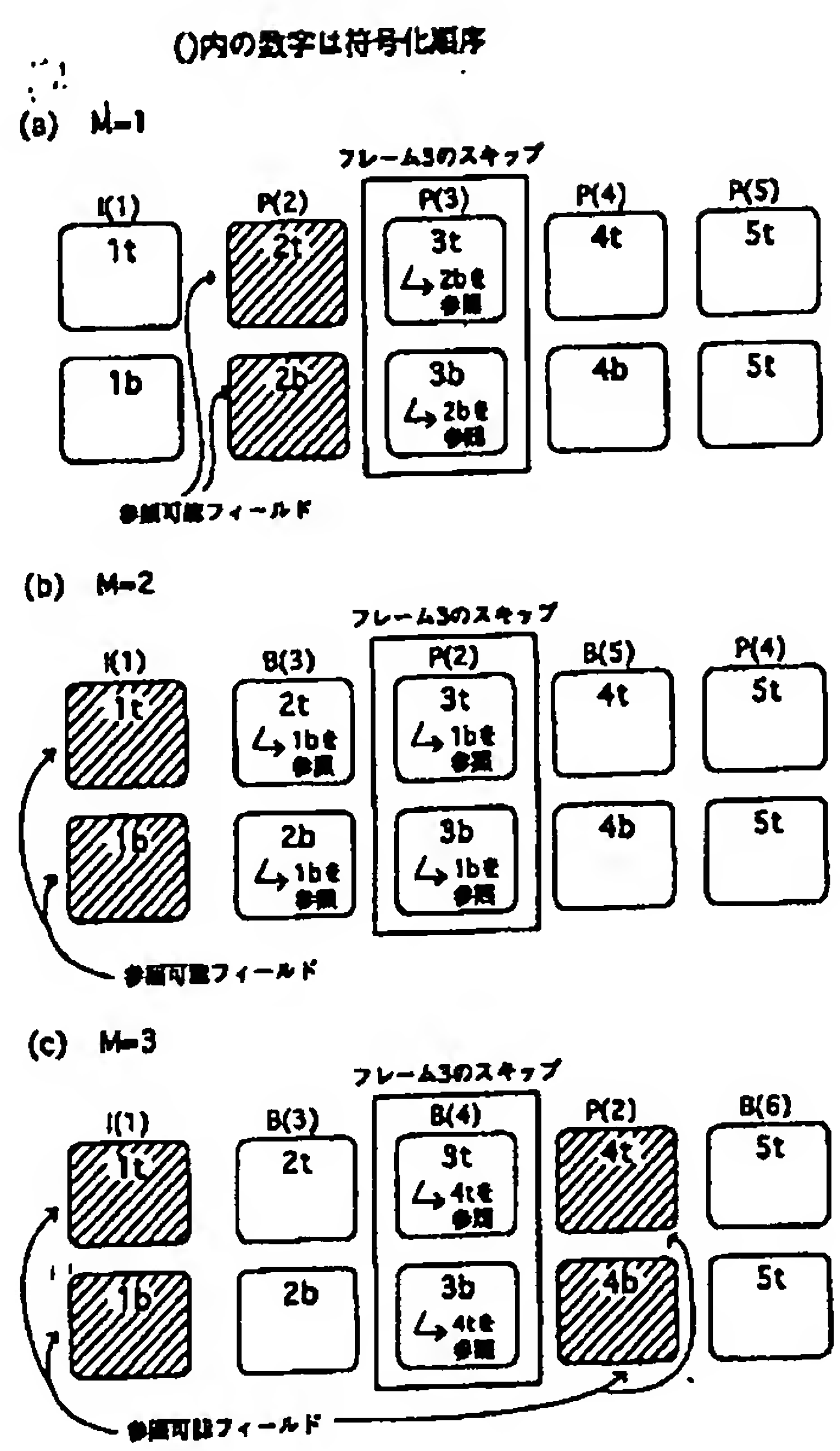
【図13】



【図15】

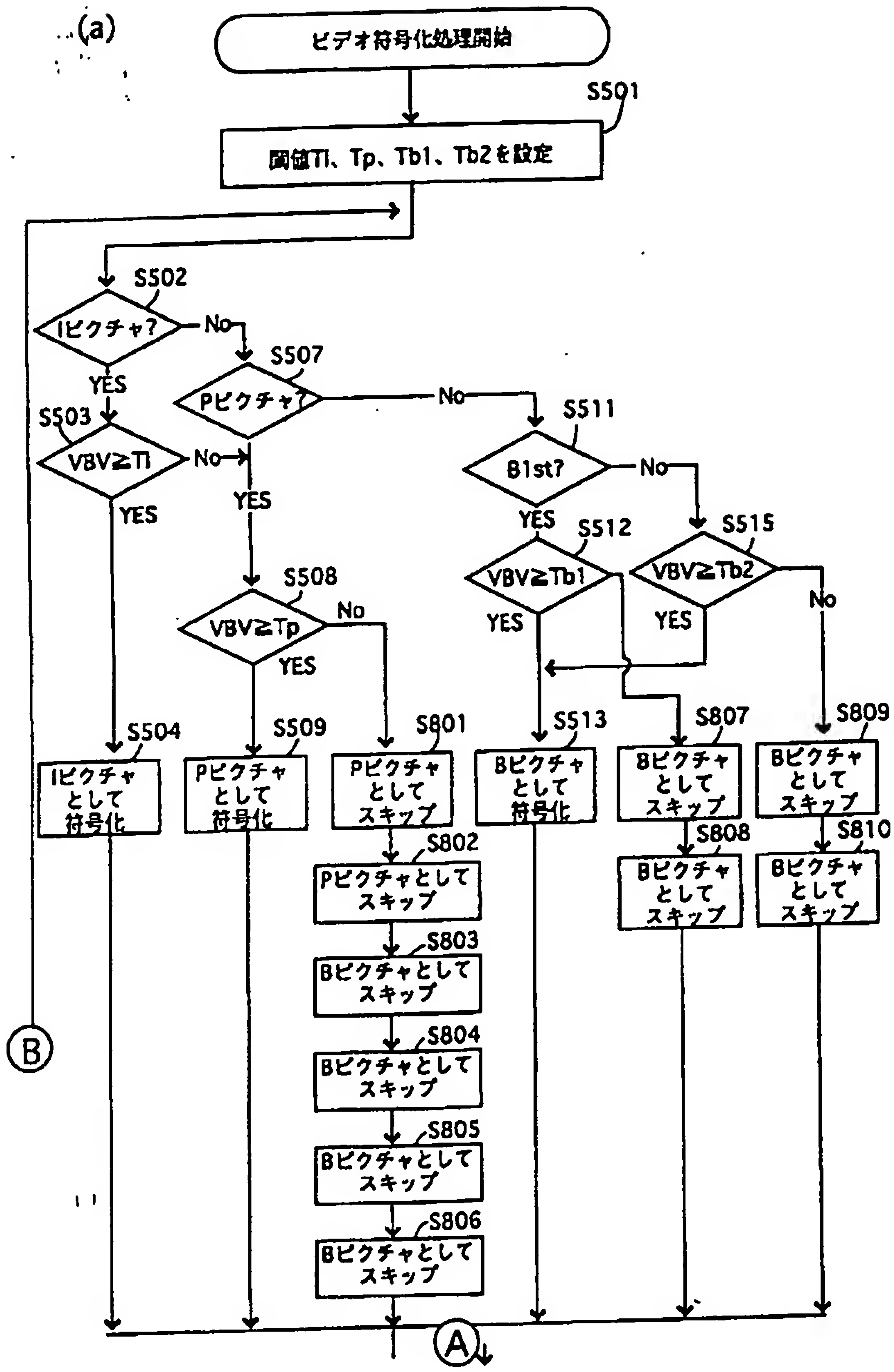


【図16】

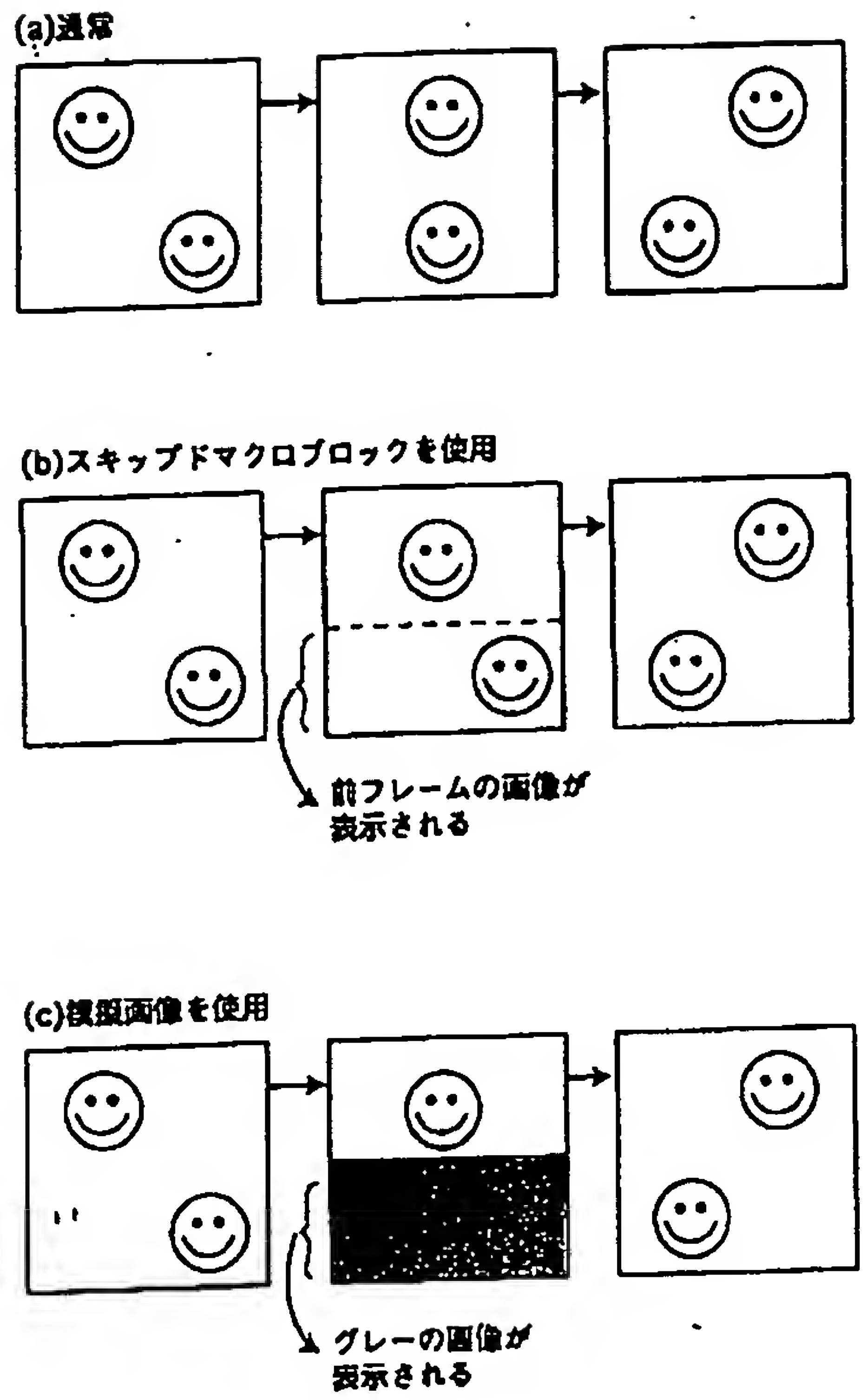


【図１８】

(a)

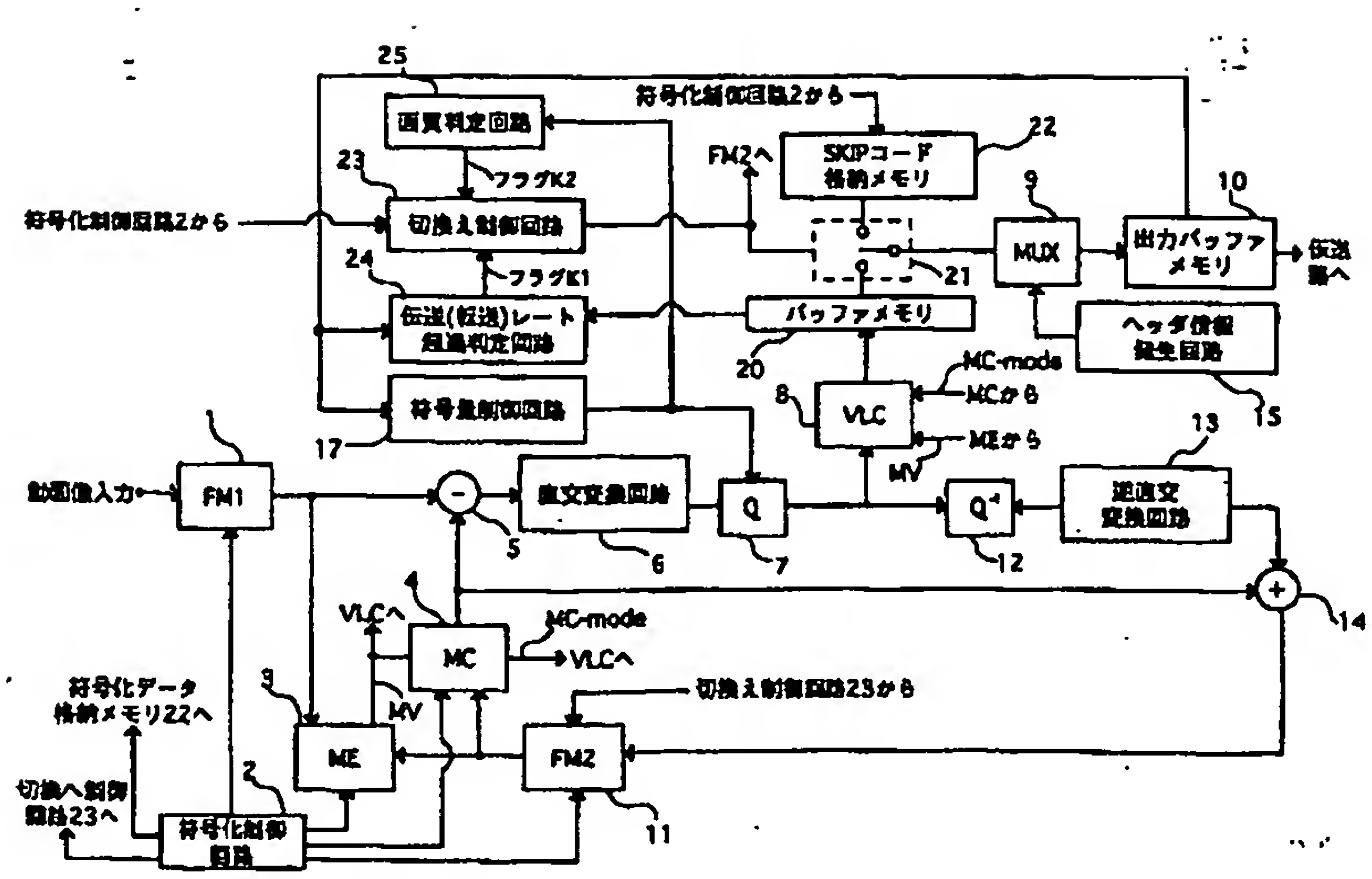

ビデオ符号化処理開始
S501
閾値TI、Tp、Tb1、Tb2を設定
S502
Iピクチャ?
No
YES
S503
VBV≧TI
No
YES
S507
Pピクチャ?
No
YES
S508
VBV≧Tp
No
YES
S511
B1st?
No
YES
S512
VBV≧Tb1
YES
S515
VBV≧Tb2
YES
No
S504
Iピクチャとして符号化
S509
Pピクチャとして符号化
S801
Pピクチャとしてスキップ
S802
Pピクチャとしてスキップ
S803
Bピクチャとしてスキップ
S804
Bピクチャとしてスキップ
S805
Bピクチャとしてスキップ
S806
Bピクチャとしてスキップ
S513
Bピクチャとして符号化
S807
Bピクチャとしてスキップ
S808
Bピクチャとしてスキップ
S809
Bピクチャとしてスキップ
S810
Bピクチャとしてスキップ
B
A

【図２１】



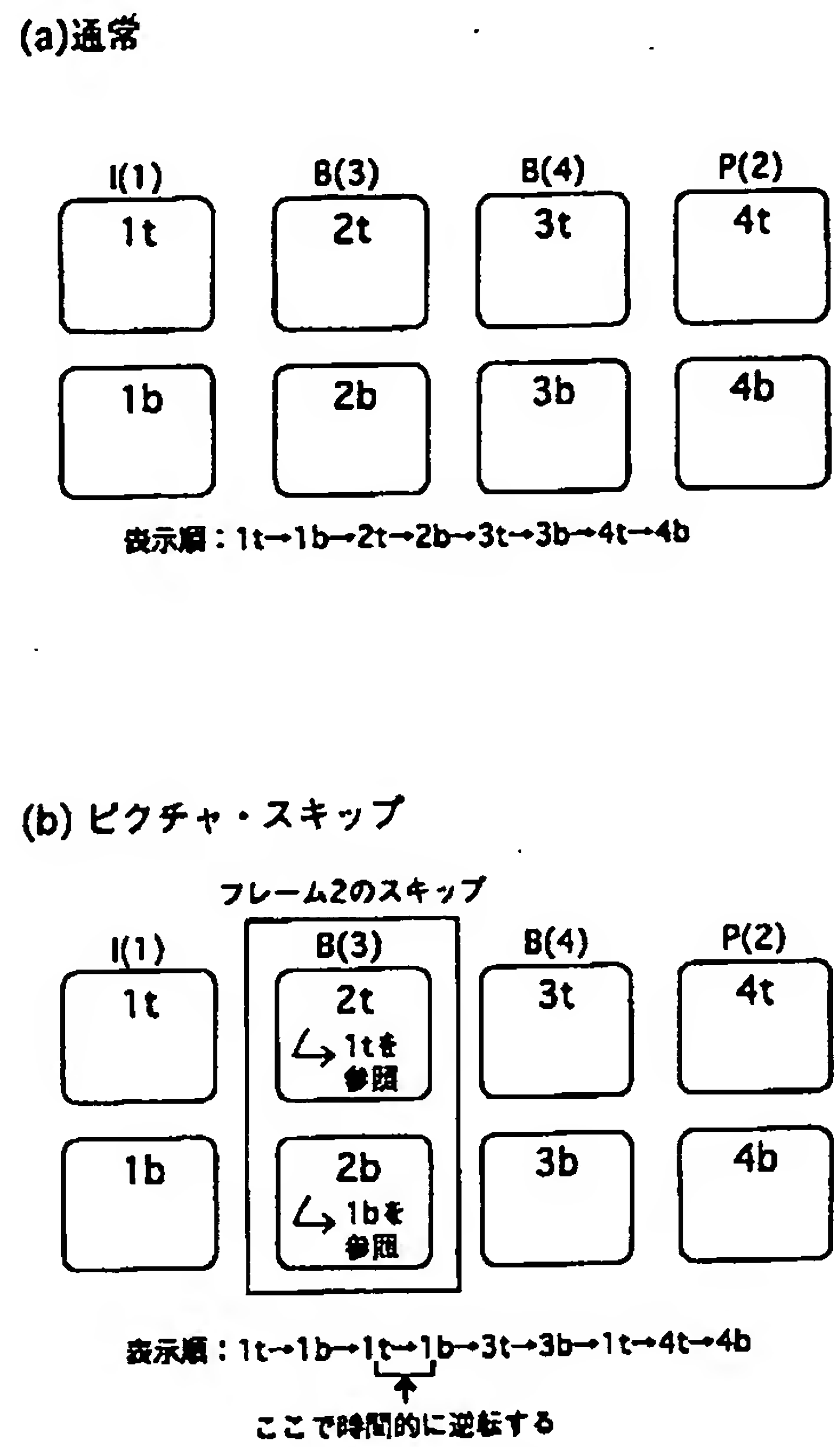
(a)通常
(b)スキップドマクロブロックを使用
前フレームの画像が表示される
(c)模擬画像を使用
グレーの画像が表示される

【図２２】



画質判定回路
フラグK2
切換え制御回路
フラグK1
伝送(転送)レート超過判定回路
符号量制御回路
符号化制御回路2から
SKIPコード格納メモリ
FM2へ
バッファメモリ
MUX
出力バッファメモリ
伝送路へ
ヘッダ情報発生回路
VLC
MC-mode
MCから
MEから
MV
動画像入力
FM1
直交変換回路
Q
Q^{-1}
逆直交変換回路
MC
VLCへ
ME
FM2
切換え制御回路23から
符号化データ格納メモリ22へ
切換え制御回路23へ
符号化制御回路

【図２３】



フロントページの続き

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5J064 BA09 BA16 BB03 BC01 BC08 BC14 BC16 BC22 BD01